UNITED STATES ARMY MEDICAL BIOENGINEERING RESEARCH & DEVELOPMENT LABORATORY

REPORT MEDDH-288 (R1)

ANNUAL PROGRESS REPORT
1 October 1983 - 30 September 1984

VOLUME 1

FORT DETRICK, FREDERICK, MD. 21701-501

REPORT MEDDH-288 (R1)

ANNUAL PROGRESS REPORT
1 October 1983 - 30 September 1984

V O L U M E 1

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MEDDH-288 (R1)	2. GOVT ACCESSION NO. AD-A157 313	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) US Army Medical Bioengineering Research and Development Laboratory Annual Progress Report FY84 VOLUME 1		5. TYPE OF REPORT & PERIOD COVERED 1 Oct 1983 - 30 Sep 84 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) CARL E. PEDERSEN, Jr., Ph.D., COL MS		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Medical Bioengineering Research and Development Laboratory Fort Detrick, Frederick, MD 21701-5010		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS See Reverse
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Medical Research and Development Command Fort Detrick, Frederick, MD 21701-5012		12. REPORT DATE 1 October 1984 13. NUMBER OF PAGES 56
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES This is the first of the two volumes of this report and contains a summary of the laboratories resources and research program for 1984.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Field Sanitation and Water, Conventional Weapon Systems, Smokes/Obscurants, Synthetic or Alternative Fuels, Environmental Quality, Installation Restoration, Aquatic Toxicology, Combat Medical Material, Environmental Fate, Chemical Protective Equipment, Field X-Ray Equipment, Hazardous/Toxic Waste Disposal, Pest Management, Pesticide Dispersal Equipment, Munition and other Wastewater Treatment,(see reverse)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Annual Progress Report, Fiscal Year 1984, summarizes in two volumes the research performed by the US Army Medical Bioengineering Research and Development Laboratory in projects authorized by The Surgeon General, the US Army, and the Commander, US Army Medical Research and Development Command, and supported by RDTE funds from the US Army Medical Research and Development Command.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Block 10.

61101A 3A161101A91C.LA.010
61101A 3A161101A91C.LA.070
61101A 3A161101A91C.LA.072
61101A 3A161101A91C.LA.073
61101A 3A161101A91C.LA.318
61101A 3A161101A91C.LA.319
61101A 3A161101A91C.LA.320
61101A 3A161101A91C.LA.323
61101A 3A161101A91C.LA.324
61101A 3A161101A91C.LA.330
61101A 3A161101A91C.LA.331
61101A 3A161101A91C.LA.332

61102A 3E161102BS04.AA.002
61102A 3E161102BS04.AA.003
61102A 3E161102BS04.AA.041
61102A 3E161102BS04.AA.042
61102A 3E161102BS04.AA.043
61102A 3E161102BS04.AA.044
61102A 3E161102BS04.AA.045
61102A 3E161102BS04.AA.046
61102A 3E161102BS04.AA.049
61102A 3E161102BS04.AA.054
61102A 3E161102BS04.AA.056
61102A 3E161102BS04.AA.057

61102A 3M161102BS10.AS.045
61102A 3M161102BS10.AS.331
61102A 3M161102BS10.CC.341

61102A 3M161102BS12.AE.030
61102A 3M161102BS12.AE.031
61102A 3M161102BS12.AE.032

65804A 3P665804M802.BA.004
65804A 3P665804M802.CA.167

64717A 3S464717D832.AA.003
64717A 3S464717D832.BB.004
64717A 3S464717D832.AA.014
64717A 3S464717D832.BB.015
64717A 3S464717D832.BA.041
64717A 3S464717D832.BA.042
64717A 3S464717D832.BA.043
64717A 3S464717D832.AA.044
64717A 3S464717D832.AA.046
64717A 3S464717D832.AA.047

62720A 3E162720A835.AA.001
62720A 3E162720A835.AA.003
62720A 3E162720A835.AA.005
62720A 3E162720A835.AA.006
62720A 3E162720A835.AA.007
62720A 3E162720A835.AA.008
62720A 3E162720A835.AA.010
62720A 3E162720A835.AA.011
62720A 3E162720A835.AA.012
62720A 3E162720A835.AA.013
62720A 3E162720A835.AA.014
62720A 3E162720A835.AA.015
62720A 3E162720A835.AA.019
62720A 3E162720A835.AA.039
62720A 3E162720A835.AA.055
62720A 3E162720A835.AA.059
62720A 3E162720A835.AA.075
62720A 3E162720A835.AA.094
62720A 3E162720A835.AA.121
62720A 3E162720A835.AA.123
62720A 3E162720A835.AA.156
62720A 3E162720A835.AA.159
62720A 3E162720A835.AA.160
62720A 3E162720A835.AA.290

63732A 3S463732D836.BB.004
63732A 3S463732D836.AA.005
63732A 3S463732D836.BB.007
63732A 3S463732D836.BB.008
63732A 3S463732D836.BB.009
63732A 3S463732D836.BB.010
63732A 3S463732D836.BB.011
63732A 3S463732D836.BA.012

64757A 3M464757D848.CB.002

62770A 3M162770A870.BB.261
62770A 3M162770A870.BB.262
62770A 3M162770A870.BB.264
62770A 3M162770A870.BB.265
62770A 3M162770A870.BB.266
62770A 3M162770A870.BB.267

62772A 3S162772A874.BA.221
62772A 3S162772A874.BA.222
62772A 3S162772A874.BA.223
62772A 3S162772A874.BA.226
62772A 3S162772A874.BA.227
62772A 3S162772A874.BA.228
62772A 3S162772A874.BA.232
62772A 3S162772A874.BA.236
62772A 3S162772A874.BA.260

See attached sheet

Block 10, Continued.

62734A 3M162734A875.BB.221
62734A 3M162734A875.CB.223
62734A 3M162734A875.CB.224
62734A 3M162734A875.CB.226
62734A 3M162734A875.CA.227
62734A 3M162734A875.AM.228
62734A 3M162734A875.AM.229
62734A 3M162734A875.AM.230
62734A 3M162734A875.AM.241
62734A 3M162734A875.CB.242

62777A 3E162777A878.CA.282
62777A 3E162777A878.CA.284
62777A 3E162777A878.CA.285
62777A 3E162777A878.CA.286
62777A 3E162777A878.CA.287
62777A 3E162777A878.CA.289
62777A 3E162777A878.CA.290
62777A 3E162777A878.CA.291
62777A 3E162777A878.CA.294
62777A 3E162777A878.CA.296
62777A 3E162777A878.CA.298

63751A 3M463751D993.BA.001
63751A 3M464751D993.CA.002
63751A 3M464751D993.BA.003
63751A 3M464751D993.BA.004
63751A 3M463751D993.BA.005
63751A 3M463751D993.CA.006
63751A 3M463751D993.CA.007
63751A 3M463751D993.CA.008
63751A 3M463751D993.CA.009

63764A 3M463764D995.AA.031
63764A 3M463764D995.AA.032
63764A 3M463764D995.AA.033
63764A 3M463764D995.AA.034
63764A 3M463764D995.AA.035
63764A 3M463764D995.AA.036
63764A 3M463764D995.AA.037
63764A 3M463764D995.AA.038

Block 19.

Chemical Hardening of Medical Equipment, Patient Dosimeter, Resuscitation Devices, Chemical Agent Identification/Quantitation, Vector Control Methods, Field Medical Refrigeration Equipment, Field Sterilization Equipment, Medical Grade Water, Field Gurney, Noninvasive Vital Sign Monitors, Controlled Release Pesticides, Microbial Fate, Organic Chemistry, Environmental Biology, Inorganic Chemistry, Hygiene, Environmental Container, Field Oxygen Generation, Teleradiography, Foreign Medical Materiel, Environmental Modelling, Inhalation Toxicology, Teratology

REPORT MEDDH-288 (R1)

US ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LABORATORY ANNUAL PROGRESS REPORT FY84

US ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LABORATORY
Fort Detrick
Frederick, Maryland 21701-5010

1 October 1984

Annual Progress Report for Period 1 October 1983 - 30 September 1984

US ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
Fort Detrick
Frederick, Maryland 21701-5012

NOTICE

Disclaimer

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Disposition

Destroy this report when it is no longer needed. Do not return it to the originator.

TABLE OF CONTENTS VOLUME 1

INTRODUCTION

The US Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) is one of nine laboratories of the US Army Medical Research and Development Command, and is a tenant organization located at Fort Detrick, Maryland. The USAMBRDL is the only laboratory to perform research and development efforts within all of the parent Command's research areas. In effect, we may best be characterized by broad mission responsibilities being met by a diversified multidisciplinary team of scientists and engineers performing basic and applied research and development. The overall mission focuses on the protection of soldiers in combat and training scenarios, employees in Army-unique industrial exposure settings, and the environment.

Our concern for the soldier stems from the potential operational employment of US Army troops in any area of the world to meet a wide spectrum of contingencies. To be prepared for deployment, personnel must undergo rigorous and realistic training. Therefore, the soldier will be exposed to not only the Army-unique hazards experienced in combat, but also those occupational hazards of the training environment. Our goal is to develop data through research which will provide relief for the soldier from the hazards inherent in military operations, worldwide.

In addition, the USAMBRDL fulfills The Surgeon General's research responsibilities in the protection of industrial workers and the surrounding community at Army-controlled, industry-operated munition plants. Our Environmental Quality program provides that data base needed to enable the Army to establish standards for compliance with Executive Orders and the Clean Air and Water Acts as well as to develop pollution abatement procedures for Army munition plants and military installations.

Our Laboratory is also actively engaged in the development and ultimate fielding of field deployable military medical equipment and vector control systems materials and equipment. These efforts are driven by the combat developer and are targeted to resolve recognized deficiencies described in the medical mission area analysis. To this end medical materiel development in this Laboratory is managed under three discipline areas: Field Medical Equipment, Chemical Combat Casualty Care and Vector Control Systems.

The USAMBRDL, established just over a decade ago by the merger of three separate Army Laboratories, is therefore deeply committed to the soldier and the environment not only by mission responsibilities but also by the efforts of a dedicated staff. We are moving with the sure steps of a firmly established research organization of the 1980's to the needs of the Army in the 1990's and beyond.

This annual report presents the efforts of this Laboratory in two volumes. The first is a compact document which presents an overview of all efforts within the organization and may be viewed as an annual posture statement. The second provides in more detail, each of our research and development Work Unit summaries. We provide the results of our programs for evaluation so that we may deliver the best product possible for US Army use.

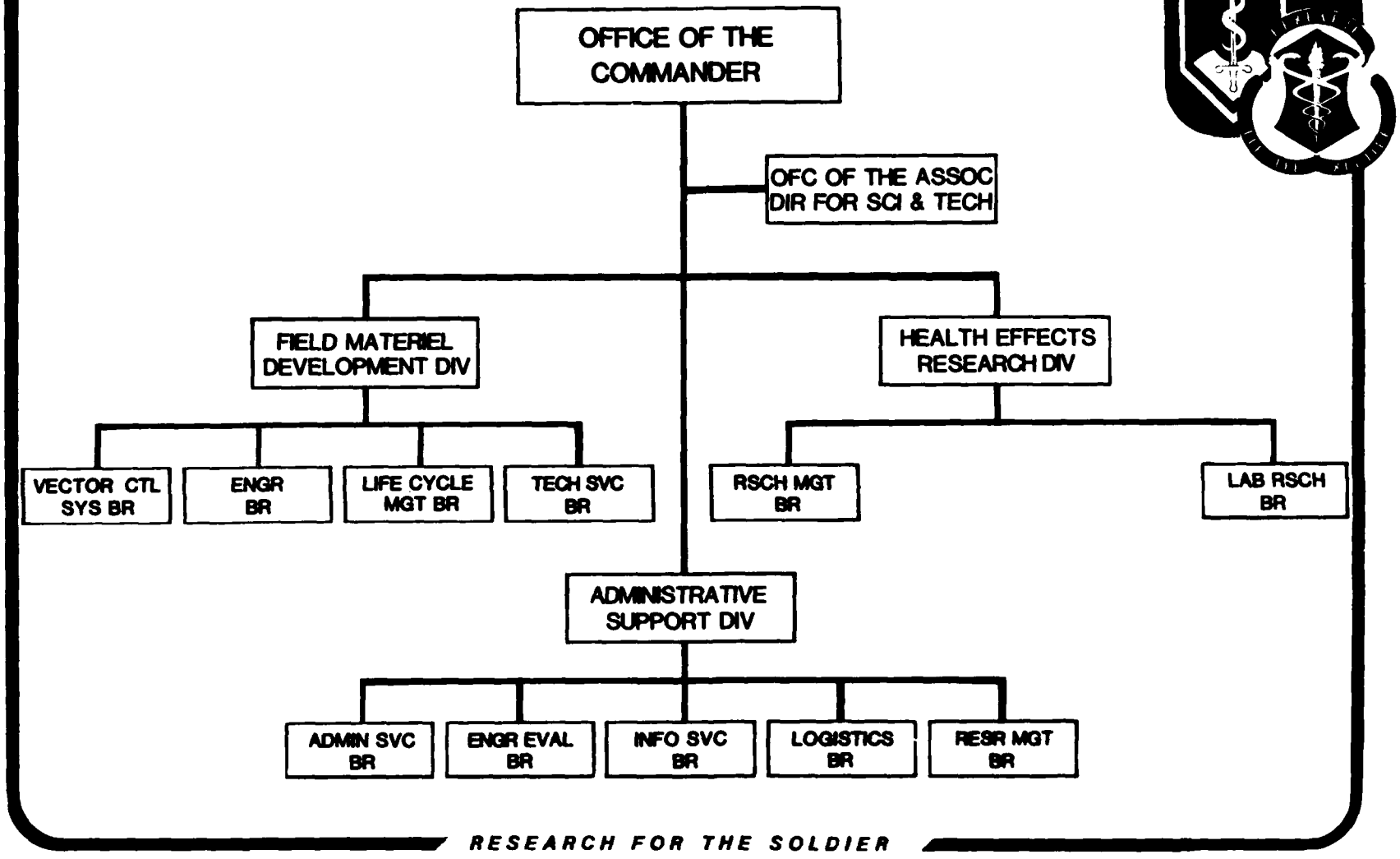
PURPOSE

The United States Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) serves the needs of the soldier in the field through Research and Development to enhance Preventive Medicine and Medical Equipment Capabilities, and to address Environmental and Occupational Health concerns related to Chemical Substances from Army Industrial and Field Operations.

MISSION

The United States Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) conducts basic research in the areas of field medical materiel, vector control systems, health hazard assessments and environmental health effects. It also develops or modifies, tests, and evaluates field medical, dental and water treatment equipment and technologies, as well as develops vector control and field sanitation methods, materials and equipment to meet military needs. The Laboratory establishes atmospheric and water related health hazard data bases for occupational and field exposures to chemicals and microorganisms and provides exposure guidance and recommends criteria and develops and recommends environmental criteria and pollution abatement procedures for chemical substances from Army industrial and field operations. In addition, USAMBRDL provides research, consultation and technical services to the Army and other federal agencies as requested.

US ARMY MEDICAL BIOENGINEERING R&D LAB



RESEARCH FOR THE SOLDIER

PROGRAM FUNDING

In-house laboratory operations are financed with Program 6 (RDTE) direct funds from Headquarters, US Army Medical Research and Development Command (USAMRDC), and reimbursable funds from Army and other DOD customers. Execution of the FY84 programs resulted in obligations of 95.3% and disbursements of 73.1%, exceeding the obligation and disbursement targets established by higher headquarters. In FY84, purchases of special purpose items created a one-time surge in expenditures with the FY85 program moderating to a normal growth pattern. High priority contract (extramural) expansion occurred in FY84; however, monitorship of the 6.3B and 6.4 extramural program was transferred to US Army Medical Materiel Development Activity (USAMMDA), effective with the FY85 program.

IN-HOUSE FUNDS
($000)

Program	FY83	FY84	FY85
6.1 Research	453	488	353
(ILIR)	(90)	(100)	(60)
6.2 Exploratory Development	3,271	3,778	3,876
6.3 Advanced Development	403	839	504
6.4 Engineering Development	498	561	987
6.5 Management and Support	387	244	154
Customer Funded	550	469	391
TOTAL	5,562	6,379	6,265
Contract (extramural)	7,863	16,412	7,046

FIELD MATERIEL DEVELOPMENT DIVISION

The Field Materiel Development Division (FMDD) consists of a team of scientists, engineers, draftsmen, and technicians. It is responsible for conducting in-house and extramural research and development of field medical, dental, and vector control equipment used to support diagnosis, treatment, and evacuation of combat casualties. This equipment is also used for preventive medicine in a military field environment.

BRANCHES

The Engineering Branch provides research and engineering expertise to develop, design, and improve US Army Medical Department (USAMEDD) equipment and materiel. It also provides technical guidance from the initial concept through item validation, production contracting, field testing, and deployment.

The Vector Control Systems Branch supports The Surgeon General's responsibilities in the area of disease vector control equipment and systems for military use. It provides consultation services to the Department of Army (DA), Department of Defense (DOD), and other civilian agencies as required. It conducts in-house research, development testing, and evaluation of vector control materials and methodologies.

The Life Cycle Management Branch establishes life cycle plans for developmental medical equipment for USAMEDD field use. It monitors development programs from initial concept through operational validation, full-scale development, production, and deployment of the equipment. It coordinates with combat developers; research and development activities; and Headquarters, DA; for the production, logistic support, training, personnel requirements, and other actions which relate to the development, acquisition, and maintenance of mission essential medical equipment.

The Technical Services Branch provides the personnel, technical knowledge, and equipment to design, fabricate, and test development prototypes of field medical materiel. It confers with manufacturers and other agencies, researches raw materials and hardware, and provides cost analysis for time and material. The services are provided to and used by all elements of the US Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) and other US Army Medical Research and Development Command (USAMRDC) laboratories.

Visitors (Continued)

17 July - MAJ (Dr.) Philppe Reh, Israeli Defense Force
MAJ (Dr.) Zelig Shlesinger, Israeli Defense Force

6 August - BG Mushtag Hussain Kazmi, Assistant Director, Medical Services, Kharian Logistic Area - Pakistan Armed Forces
BG Suleman Khan, Commanding Officer, Pakistan Air Force Hospital
BG Abdul Rafig Burki, Assistant Director, Medical Services, Med DTE, GHQ, RWP
CPT Khawaja Ensan Aslam, Deputy Director Medical Services, Naval Headquarters, Islamabad

21 October - Surgeon Commander K. Delaney, Royal Australian Navy, Health Services Directorate, Australia (Return Visit)

TOUR GROUPS

11 April - COL Richard A. Hodder, Division of Medicine, Walter Reed Army Medical Center and MAJ Clarion E. Johnson, CPT(P) John G. Schmitz, CPT(P) Edward W. Bernton, and Ms. Barbara J. Cunegin, Faculty and Fellows in the Military Medical Science Fellowship and Staff, Walter Reed Army Institute of Research

14 August - CPT Alphonso Horton, CPT Ronnie Brannon, CPT Donald Buchwald and 1LT Thomas Clines, students enrolled in the Medical Materiel Management Course (USAMMA)

6 September - COL Richard A. Hodder, Division of Medicine, Walter Reed Army Medical Center and MAJ Clarion E. Johnson, CPT(P) John G. Schmitz, CPT(P) Edward W. Bernton and Ms. Barbara J. Cunegin, Faculty and Fellows in the Military Medical Science Fellowship and Staff, Walter Reed Army Institute of Research

VISITORS

During fiscal year 1984, the USAMBRDL received many distinguished visitors who toured the facility. The groups included DOD and DA officials, flag grade officers, foreign visitors, fellows, students, secondary school faculty members and visitors from the local community. The following list represents those visitors for whom organizational briefings and tours were provided. Workshop attendees and other conferees are cited in other sections of this report.

FLAG

7 October - BG Girard Seitter, III, Director of Health Care Operations, Office of The Surgeon General

OSD-DA-MACOM

10 February - COL John Hayes, AMEDD Test Board, Academy of Health Sciences, Fort Sam Houston, Texas

27 February - LTC Lyndon E. Mansfield, Chief, Department of Clinical Investigation, William Beaumont Army Medical Center;
LTC Timothy M. Boehm, Chief, Department of Clinical Investigation, Walter Reed Army Medical Center

6 October - COL James Connolly, TRADOC Surgeon

17 October - LTC Donald R. Ciliax, Biomedical Career Manager, Medical Service Corps Career Activities Office, US Army Medical Department Personnel Support Agency

20 October - Mr. Richard Lewis, Director of Army Research and Technology, ODCRDA
Dr. Leo Young, Director, Research and Technical Information, OUSDRE (R&AT)
Dr. Thomas J. Kierman, OUSDRE (R&AT/RLM)
Dr. Ivan Bennett, University of New York Medical School (Member, Defense Science Board and University Forum)

COMMUNITY

10 February - Mr. and Mrs. George B. Delaplaine, Jr., Publishers of the Frederick News Post

FOREIGN

14 February - Dr. Per Thoresen, Norwegian Defense Research Institute
LTC Tore Naess, Military Attache, Royal Norwegian Embassy

6 July - MAJ Jean Belard, DRET/ETCA, Paris, France (Physician in the French Army

Maryland Hazardous Substance and Low-Level Nuclear Waste Advisory Council	Public Member	Dr. Rosenblatt
Science Review Panel for Health Research, US Environmental Protection Agency	Member	Dr. Henry
Science Review Panel for Health Research, US Environmental Protection Agency	Member	Dr. Dacre
The Environmental Science and Technology Journal	Reviewer of Manuscripts	Dr. Rosenblatt
The Society of Environmental Toxicology and Chemistry	Board of Directors	Dr. Rosenblatt
TWIG for 3000 GPH Reverse Osmosis Water Purification Unit	Representative	Dr. Schaub

Association for the Advancement of Medical Instrumentation (AAMI)	Member	LTC(P) Goethals
ASTM Task Group D19:24:04:04 Virus in Solids - Part of the D19 Committee on Water for Standards Development	Chairman	Dr. Schaub
DCSLOG Sponsored Water Resources Management Action Group	USAMBRDL Representative	Dr. Schaub
DOD Committee for Development of a Master R&D Plan for Research in Field Water Supply	Member	Dr. Schaub
DOD Steering Committee for "Data Base Assessment of Environmental and Toxicological Factors in Water to Upgrade and Modernize Content of TB Med 577"	Chairman	Dr. Schaub
Federal Laboratory Consortium	Member	LTC O'Dell
Interagency Collaborative Group on Environmental Carcinogenesis NCI (Includes the Chemical Selection Working Group)	Member	Dr. Dacre
Inter-Governmental Committee for Development of Guide Standards and Testing Protocols for "Point of Use" Water Purifiers	Chairman	Dr. Schaub
Joint Army, Navy, NASA, Air Force Environmental Health Panel of the Safety and Environmental Protection Subcommittee of the Propulsion Committee	Chairman	CPT Gardner
Joint Army, Navy, NASA, Air Force Interagency Propulsion Committee, Toxicology Working Group of Environmental Health Panel of the Safety and Environmental Protection Subcommittee	Member	Dr. Dacre
Joint Army, Navy, NASA, Air Force Space Operations Panel of the Safety and Environmental Protection Subcommittee of the Propulsion Committee	Member	CPT Gardner

Committee Participation

Committee	Affiliation	Individual
AAMI, Sterilizer Committee	Member	LTC(P) Goethals
American Industrial Hygiene Association, Ionizing Radiation Committee	Member	CPT Bratt
American Society for Testing and Materials (E-35 on Pesticides)	Member	Dr. Nelson
American Society for Testing and Materials (E-29 on Particle Size Measurement)	Member	Dr. Nelson
American Society for Testing and Materials (E-35 on Pesticides)	Member	Mr. Vorgetts
American Society for Testing and Materials	Member	Mr. Salisbury
American Society for Testing and Materials Committee on Environmental Fate of Effects (E-47)	Member	Dr. van der Schalie
American Water Works Association, Executive Committee for Wastewater Reuse	Member	Dr. W. Burrows
Armed Forces Pest Management Board (Equipment Committee)	Vice Chairman	CPT Boobar
Armed Forces Pest Management Board (Equipment Committee)	Member	Dr. Nelson
Armed Forces Pest Management Board (Medical Entomology Committee)	Member	Dr. Nelson
Association of Operating Room Nurses (AORN)	Member	LTC(P) Goethals
Association for the Advancement of Medical Instrumentation (AAMI)	Member	Mr. Conway
Association for the Advancement of Medical Instrumentation (AAMI)	Member	Mr. O'Connor
Association for the Advancement of Medical Instrumentation (AAMI)	Member	Mr. Prensky
Association for the Advancement of Medical Instrumentation (AAMI)	Member	Mr. Salisbury

College Education Level

	Military	Civilian	TOTAL
Bachelors	10	20	30
Masters	13	10	23
Doctorate	2	17	19

Additional Personnel Assets

(Intermittent Employment, FY84)

	No. Personnel
Summer Associateship, High School Science & Math Faculty	2
Summer Science & Engineering Apprentice Program	3
Student Volunteers (College Students)	2
Student Aids	4
Summer Hire (Temporary)	1
Individual Mobilization Augmentee (IMA)	8

Awards

Civilian

Sustained Superior Performance	7
Quality Step Increase	4
Merit Pay Cash Award	4
Special Act	1
Suggestion Award (Cash)	1

Military

Defense Superior Service Medal	1
Legion of Merit	1
Meritorious Service Medal	1
Army Commendation Medal	3
Army Achievement Medal	2

Promotions

Officer	2
Enlisted	3
Civilian	7

Achievements

SP5 Terry W. Roberts was selected as Fort Detrick's Outstanding Man of the Year
SP4 Michael R. Sardelis won the Fort Detrick Soldier of the Year Competition
SP5 Jeffrey R. Ryan was selected for Officers' Candidate School.
SP5 Jeffrey R. Ryan and SP4 Michael R. Sardelis earned the Expert Field Medical Badge.

Professional Categories of Personnel

	Military	Civilian	TOTAL
Scientist	9	20	29
Engineer	3	14	17
Clerical	-	21	21
Technician	13	21	34
Administrative	6	15	21
Wage Grade	-	9	9

Logistics

During the 1st quarter of FY84 the Logistics Branch underwent a Command Supply Inspection with an overall report of excellent. Excess equipment turned in was valued at $82,161.00. Much of the Laboratory furniture was purchased from the GSA Refurbishing Center at Springfield, VA, at a substantial savings to the Government. A system was established using the Ramtek and IBM Computers to retrieve printouts on the immediate status of equipment under procurement. The Property Management and Biomedical Equipment Sections had the Vertical Installation Automation Baseline (VIABLE) System installed to produce a more rapid turnaround of their records. The preventive maintenance completion rate is approximately 80% for FY84. The Test, Measurement, and Diagnostic Equipment (TMDE) Program has improved considerably; we are now calibrating approximately 60% of TMDE here at the Laboratory and expect to increase this with each visit made by the calibration team from Letterkenny Army Depot. A major turnover of personnel occurred during the year with the loss of the Chief, Logistics Branch; Chief, Supply; and the Property Management Officer.

The distribution of property book line items for the Laboratory is as follows:

	Line Items	Value
Administrative Support Division	367	$ 876,845
Field Materiel Development Division	724	$1,873,070
Health Effects Research Division	563	$1,740,562

PERSONNEL FY84

The Table of Distribution and Allowances and actual strength are summarized as follows:

	Requirements	Authorizations	Actual
Officers	21	16	17
Enlisted Members	15	15	17
Civilians	118	100	99

Equipment involved in Developmental Testing included a Low Capacity X-ray System, two Gas Powered Ventilators, and a Multicapability Pesticide Dispersal Unit (Helicopter Slung). First Article Testing included testing of 1- and 2-Gallon Sprayers, and a Sterilizer used to quickly sterilize surgical instruments and dressings in the field. Engineering evaluations involved the testing of Field Litter Covers being considered for chemical hardening of equipment, a Thermoelectric Field Refrigerator, a newly marketed Rescue Stretcher, and a Modified Chlorination Kit for Water Purification. The sources of this equipment were either the private sector, other government agencies, or in-house products.

A significant amount of time was spent providing advice and consultations in the areas of test methodology, development of protocols, and upgrading equipment performance standards, to support engineers or investigators in effecting recommended modifications to equipment or the preparation of equipment for field operations. One problem area centered around slippages in the equipment development schedule, resulting in a reduction or compression in the time allotted for Developmental Testing to adhere to the Operational Test Schedule.

The present workload is delicately balanced against available human resources. A significant increase in the workload will require increased manpower. Estimates at this time suggest that the present status of resources and the workload are likely to remain constant for the immediate future. Ongoing field exercises, evaluation of foreign medical equipment, and relationships with other agencies could have a significant impact.

Memorandum Reports.

No.	Title
14-83	First Article Test of Sterilizer, Surgical Instrument & Dressing
15-83	Field Gurney, DT I
16-83	Engineering Evaluation of BILAN Refrigerator
1-84	Low Capacity X-Ray System, DT I
2-84	First Article Test of One-Gallon Sprayer, Insecticide, Manual
3-84	Litter Covers, PPL Mesh
4-84	Litter Pole Handle, Load Deflection
5-84	First Article Test of Two-Gallon Sprayer, Insecticide, Manual
7-84	Pesticide Dispersal Unit, Multipurpose, Helicopter Slung, DT I
8-84	SKEDCO Stretcher Test Report
9-84	Puritan-Bennet Gas Powered Ventilator DT Report
10-84	Mine Safety Appliance Gas Powered Ventilator DT Report
11-84	New Chlorination Kit (Water Purification), Independent Evaluation

Automation. Local area networking of personal computers was introduced to the Laboratory. Approvals were received and acquisition initiated for automation resources which will significantly increase the number of user workstations, central shared support resources and communications capabilities. The automated portion of the in-house management information system was supported and major portions of it were rewritten to operate on the new network. Many of these efforts will be introduced to the Laboratory in the first quarter of FY85. The automation resources purchases were:

a. Seventeen (17) computer workstations.

b. Five (5) network (shared) mass storage devices.

c. Five (5) network (shared) print server devices.

d. Communications support to interface the workstations to remote data centers.

e. Five (5) graphics terminals.

f. Vendor software as required to support the workstations.

Resources Management

The Resources Management Branch provided comptroller, manpower, and management services activities to the functional research and development divisions.

Execution of the FY84 programs resulted in exceeding the FY84 targets for obligations and disbursements.

Manpower utilization resulted in actual civilian strength equalling 99% of authorizations, augmented throughout the period by numerous highly successful intermittent employment programs. The laboratory personnel categorized by professional categories displays a wide spectrum of skills to complete customer service requests. Additionally, the array highlights a predominately civilianized (76%) laboratory work force distributed in all professional categories. The combination of a wide spectrum of specialists and experts coupled with a highly civilianized force structure require a comparable civilian grade structure and high grade quota (21) to retain the necessary skills and excellent researchers.

Engineering Evaluation

During FY84 the Engineering Evaluation Branch performed Developmental or First Article Tests, or engineering evaluations on 12 items of field medical, dental, or pest management equipment.

current estimated cost of upgrading is 1.5 million dollars. The environmental chamber was removed from the 2d Floor of Building 568 to make additional space for the newly located library in Rooms 222 and 223. The interior of Building 568 was painted and new carpeting and draperies were installed. Building 524 and the administrative area of Building 459 also received new carpeting and draperies.

ADMINISTRATIVE SUPPORT

Administrative support is provided by five functional branches: Administrative Services; Information Services; Resources Management; Engineering Evaluation; and Logistics. The laboratory executive officer serves as Chief, Administrative Support Division. The succeeding briefs represent a summary of the activities in the division.

Administrative Services

The Administrative Services Branch provides clerical, administrative, photographic, and graphic arts support. During the year, the Medical Audio Visual Section responded to many requests from staff activities in the HQ, USAMRDC, and these requests caused delays and a significant backlog in work units requested by USAMBRDL staff activities. Personnel strengths remained at authorized levels for military personnel. A decrement of five authorizations generated by the organization of a new USAMRDC unit caused an overstrength in civilian personnel and a moderate reorganization of the work effort in the Laboratory.

Information Services

Statistics. During FY84, statistical review and consultation was provided to approximately 25 extramural research efforts. The majority of the effort was devoted to the review of technical progress reports. However Requests for Proposals, scopes of work, proposals, protocols, final reports and site visits were other areas which benefited from statistical consultation. Support of in-house efforts took the form of consultations with individual researchers. Twenty five of these were significant enough to result in a statistical consulting report which was forwarded to the researcher.

Library. Library services were provided on an as-required basis to the entire Laboratory. Acquisition of text books, journals, technical information reports and maintenance of an active interlibrary loan program represented the primary components of library support. The Library gained access to databases at the National Library of Medicine and the library technician was trained in their use.

The Commander, USAMBRDL, began a series of monthly seminars designed to integrate the efforts of the scientific and engineering staff. These Scientific and Engineering Symposia (SES) are designed to present projects, seek fresh ideas and suggestions, and cross fertilize the efforts of the staff. Administrative personnel attend each SES in order to better understand research and development efforts and to engineer their own efforts for the mission.

During most of 1984, administrative services were provided by six different functional offices which had direct access to the Office of the Commander. This proved to be a very cumbersome span of control. These support services were collocated in a functional Administrative Support Division, headed by the laboratory executive officer who is dual hatted as division chief. This action was approved by Headquarters, USAMRDC, and implemented late in FY84. This reorganization resulted in clear lines of authority and responsibility and will provide the appropriate level of control for administrative support.

FACILITIES

The physical plant provides over 100,000 square feet for research, development, testing, and administrative activities. Space is allocated among the organizational elements in the following distribution:

Administrative Support Division	11,822 sq ft
Field Materiel Development Division	30,790 sq ft
Health Effects Research Division	24,396 sq ft
Common Areas	32,992 sq ft

The Laboratory initiated a number of construction and renovation projects to upgrade facilities. The renovation of the 2d Floor of Building 1054 was completed and the engineering staff and draftsmen now occupy these quarters. Work began in September 1984 on a $353,000 contract to provide effective environmental control for Building 568, with an estimated completion date of mid-April 1985. Also included in this contract is the renovation of the insectaries in Building 568. A contract for construction of an outside test facility, Building 1059, was initiated with an estimated construction cost of $57,000. An engineering technical study is currently ongoing for the renovation of Building 459 in order to comply with the US Army Environmental Hygiene Agency (AEHA), the Occupational Safety and Health Administration (OSHA) and Good Laboratory Practice (GLP) Standards. The

MANAGEMENT INITIATIVES

The USAMBRDL offered several management initiatives during the course of the year. The following briefs represent the strategic and innovative approach which characterizes the direction taken. These are not cited in any particular priority; however, collectively, they demonstrate an official attitude toward the long range and away from the traditional, quick fix methods.

In September, the Organizational Effectiveness Office at Fort Detrick, Frederick, Maryland, coordinated a Transition Conference for the Staff. This major effort was designed to bridge any management and organizational gaps created by the change of command during the year. The focus was to articulate values, goals, and purpose as they relate to the mission. Management planned a follow-on Strategic Planning Conference for FY85, and that foundation was laid with the Transition Conference.

During 1984, the building which houses the USAMBRDL industrial plant equipment was renovated to include office space for engineers and technicians. This staff was then moved from the main administrative building to the new location to improve the face to face contact between project and research area managers and the skilled trades personnel in the plant. Other renovations are discussed in the FACILITIES summary.

The acquisition and disposal of property were two key management issues during 1984. One approach represents modernization and the other represents a direction away from traditional values. During FY84, over $82,000.00 excess equipment was either recycled to allied research institutes or turned in to the Property Disposal Office. New laboratory and management equipment acquired during the year added $500,000 to the value of the property book. These acquisitions represented efforts to maintain the highest level of equipment technology and to replace marginally effective items in the shop and on the bench.

The institutional approach to domestic technology transfer was administratively improved during FY84. The duties associated with technology transfer were vested in the Executive Officer. The program was carefully reviewed and shortcomings were identified. The performance standards for many bench scientists, engineers, and branch chiefs were written to include technology transfer tasks. This initiative will improve the performance of this Laboratory. The technology transfer duties (Office of Research Technology Assessment) will be vested in a qualified scientist or engineer as soon as the recruiting process brings one on board. A position has been established for a Quality Assurance Manager. Technology transfer oversight will be a primary function in that office.

CHEMICAL DEFENSE MEDICAL MATERIEL PROGRAM

Chemical Defense Medical Materiel Program addresses the development of equipment vital for medical treatment, evacuation, and decontamination of patients in a chemical warfare environment. The problems associated with chemical defense including protection of medical materiel from exposure to toxic agents are examined, solutions proposed, evaluated, and tested.

CHEMICAL DEFENSE MEDICAL MATERIEL TASKS

CHEMICAL HARDENING OF FIELD LITTERS

Objective: To improve the existing litter or design a new litter that is not degraded by chemical warfare agents and is easily decontaminated.

Military Relevance: Decontaminability is necessary so casualties and treatment personnel won't be further exposed to or recontaminated by chemical agents during evacuation and treatment.

Progress: Several candidate litter cover materials have been obtained and tested. Preliminary tests indicate none of the materials tested are suitable for use. Renewed efforts to identify suitable materials are under way.

Contracts: Material for Handle, Plastic, Litter, Toxic Chemical Agent Resistant, DA303466, A.G.H. Industries, Inc. (Petrovic, M. F.); Patzer, N. H.

Test of Litter Cover Materials, DA0H0040, US Army Armament, Munitions, and Chemical Command (Elbaum, H.); Reams, W. H.

CHEMICAL HARDENING OF MEDICAL FIELD CHESTS

Objective: To chemically harden existing and future military medical field chests by increasing resistance to both chemical agents and decontaminating agents.

Military Relevance: The current medical chest is not resistant to chemical agents or decontamination solutions. The development of a chemically hardened chest is essential to permit the continued treatment of casualties with uncontaminated equipment and medical supplies on a chemical battlefield.

Progress: Prototype chemically hardened gaskets for the field chest have been received for test and evaluation.

In-House Work Unit: Chemical Hardening of Medical Field Chests, DA0G1513, US Army Medical Bioengineering Research and Development Laboratory (Patzer, N. H.).

Contract: Gasket Material, Rubber, Molded, Toxic Chemical Agent Resistant, DA303964, Crown Products Company (Blankenship, J. R.); Patzer, N. H.

CHEMICAL WARFARE AGENT, PROTECTIVE FIELD BATTLE DRESSINGS

Objective: To provide field dressings to protect open wounds from chemical warfare agent contamination.

Military Relevance: The survivability of US Army casualties during chemical warfare must be enhanced to save lives. Recontamination of casualties must be prevented, and dressings that incorporate antibiotic drugs that are impervious to chemical agents must be developed.

Progress: Joint Working Group will be convened by the US Army Medical Materiel Development Activity (USAMMDA) to validate the proposed concept and to initiate a requirement document.

In-House Work Units/Contracts: None

EVALUATION OF FOREIGN MEDICAL MATERIEL FOR USE IN CONTAMINATED ENVIRONMENT

Objective: To evaluate foreign medical materiel/technology/doctrine for adoption to improve USAMEDD casualty management in contaminated field environments.

Military Relevance: The survivability of US Army casualties during chemical warfare must be enhanced. The purchase of already developed and proven materiel and technology would save the US Army valuable time, money, and manpower.

Progress: Reports, equipment, and/or procedures from foreign sources are continually reviewed for potential US Army use. A West German Field Decontamination System has been received and will be evaluated by US Army Medical Research Institute of Chemical Defense (USAMRICD). The Israeli Battalion Aid Station has been received and will be evaluated 1Q85. Action has been initiated to obtain the French Parachutist Surgical Unit (FPSU) for evaluation.

In-House Work Unit: Technical Feasibility Testing of Foreign Medical Materiel for Use in a Contaminated Environment, DA0G1894, US Army Medical Bioengineering Research and Development Laboratory (Conway, W. H.).

MEDICAL STAFF CHEMICAL WARFARE AGENT DOSIMETER

Objective: To develop a small, individual dosimeter which will be sensitive to humanly undetectable but harmful, low concentrations of nerve and blister agent vapors and will alert medical staff members to these low exposure levels.

Military Relevance: This equipment is necessary to prevent medical personnel from being exposed to low levels of chemical agents and becoming casualties themselves.

Progress: Two contractors have been chosen and contracts are expected to be awarded 2Q85. One contractor will pursue a gas chromatographic design and the other contractor will pursue an electrochemical design of the dosimeter.

In-House Work Units/Contracts: None

RESUSCITATOR/VENTILATOR, GAS-POWERED, INDIVIDUAL

Objective: To develop a gas-powered resuscitator/ventilator for resuscitating chemical warfare casualties by field medical personnel.

Military Relevance: On the integrated battlefield of the future, chemical casualties will represent the greatest burden to the medical treatment system. This resuscitator/ventilator will lessen this burden by providing automated medical life support procedures to conserve scarce medical manpower and possibly provide a more effective means of resuscitating casualties.

Progress: USAMBRDL has conducted engineering tests on joint Air Force/USAMRDC test models. One model nearly matches Draft Letter of Agreement requirements. Efforts are underway to clarify requirements and prepare a Joint Service Operational Requirement (JSOR).

In-House Work Unit: Resuscitator/Ventilator, Gas-Powered, Individual (GPV), DA303504; US Army Medical Bioengineering Research and Development Laboratory (Malek, J. W.).

TECHNICAL FEASIBILITY TESTING (TFT) OF DELIVERY SYSTEMS FOR CHEMICAL WARFARE MEDICAMENTS

Objective: To determine, by market search, the best method/appliance to contain and deliver chemical warfare medicaments.

Military Relevance: The individual soldier must be issued those medicaments required to sustain his life in the event he in affected by chemical agents. The most effective container/delivery system must be provided.

Progress: Delivery of the prototype devices for in-house environmental testing and user evaluation by field units is expected in mid FY 85.

In-House Work Unit: Technical Feasibility Testing (TFT) of Delivery Systems for Chemical Warfare Medicaments, DA0G2702, US Army Medical Bioengineering Research and Development Laboratory (O'Connor, R. J.).

NBC WARFARE PATIENT NONINVASIVE (HEART RATE) SURVIVAL MONITOR

Objective: To develop a device which will allow an aidman to detect the heart rate of an NBC (Nuclear Biological Chemical) casualty noninvasively through chemical protective garments at field combat locations.

Military Relevance: To allocate the optimum medical resources, each aidman will use heart rate information to rapidly triage casualties.

Progress: Three contractors have delivered breadboard prototypes. Spare parts, manuals, and drawings for these prototypes have not as yet been delivered. These prototypes have been found to work with varying degrees of sensitivity through chemical protective clothing but have not worked adequately in a moving M113 Armored Personnel Carrier.

Contracts: Noninvasive Heart Rate Monitor, DA300494, RCA Laboratories, David Sarnoff Research Center (Nowogrodzki, M.); Thayer, C. R.

Noninvasive Chemical Casualty Vital Signs/Heart Rate Monitors, DA301115, Decision Science, Inc. (Halvorsen, K. G.); Thayer, C. R.

Noninvasive Heart Rate Monitor, DA300486, Industrial and Biomedical Sensors Corporation (Chang, K-W); Thayer C. R.

NONINVASIVE NBC WARFARE PATIENT VITAL SIGNS MONITOR

Objective: This task is aimed at developing a device which will allow an aidman to detect the vital signs (heart rate, blood pressure, respiration, and tidal volume) of an NBC casualty noninvasively through chemical protective garments at field combat locations.

Miltary Relevance: Chemical warfare will generate a nearly unmanageable number of casualties. To allocate the optimum medical resources, each aidman will use heart rate information to rapidly triage casualties.

Progress: The contractor has built a breadboard instrument that has been successful in obtainihg heart rate and blood pressure of a casualty wearing chemical protective clothing in a moving M113 Armored Personnel Carrier. Prototypes have been delivered, but manuals, spare parts, and drawings have not.

Contract: Noninvasive Chemical Casualty Vital Signs Monitor, DA301113, GMS Engineering Corporation (Samaras, G. M.); Thayer C. R.

RESUSCITATION DEVICE, INDIVIDUAL, CHEMICAL

Objective: To design and develop a manually operated, compact, lightweight medical device which can be operated by an individual soldier to ventilate chemical warfare agent casualties during their initial/frontline treatment.

Military Relevance: Immediate resuscitation of chemical casualties is one of the vital life support treatments required for a nerve agent casualty.

Progress: Burgin adapters have been received. Chemical agent filters which can be attached to the Burgin adapter for cricothyroidectomy procedures were designed and fabricated by the Chemical Research and Development Center (CRDC). These filters have been received and will be subjected to Development Testing (DT) 1Q85. A contract has been awarded to Mine Safety Appliances Research Corporation to design and produce models. Delivery of these devices is anticipated 2Q85.

In-House Work Unit: Resuscitative Device, Individual, Chemical, DA0G1512, US Army Medical Bioengineering Research and Development Laboratory (Malek, J. W.).

Contracts: Resuscitation Device, Individual, Manually Operated, Field, DA303070, Mine Safety Appliances Research Corporation (Rankin, R. L.); Malek, J. W.

Resuscitation Device, Individual, Chemical (Burgin Adapter), DA304547, Globe Safety Equipment, Inc. (Brockman, D.); Malek, J. W.

Filter System - Resuscitation Device, Individual, Chemical (Burgin Adapter), DA303157, US Army Armament, Munitions and Chemical Command, Chemical Research and Development Center (Boardway, J.); Malek, J. W.

CHEMICAL WARFARE AGENT, PROTECTIVE PATIENT WRAP

Objective: To develop a chemical warfare agent protective patient wrap capable of protecting decontaminated casualties from all known chemical agents during evacuation in a field environment.

Military Relevance: The survivability of casualties during chemical warfare is mandatory. The protective patient wrap is necessary to prevent recontamination and/or death of decontaminated casualties awaiting evacuation.

Progress: Protective patient wraps have been developed at the US Army Natick Research and Development Center (NRDC). Fabric materials and closures are being tested at Dugway Proving Ground (DPG). Respiratory and physiological testing are scheduled for early 1985.

Contracts: Chemical Warfare Agent Patient Protective Wrap, DA0G7067, US Army Natick Research and Development Center (Snow, P.); Reams, W. H.

Chemical Agent Testing of the Chemical Warfare Agent Protective Patient Wrap, DA304534, US Army Dugway Proving Ground (Rice, W.); Reams, W. H.

COMBAT MEDICAL MATERIEL PROGRAM

Combat Medical Materiel Program provides The Surgeon General with specialized or improved medical equipment which fill recognized military requirements.

COMBAT MEDICAL MATERIEL TASKS

FILMLESS RADIOLOGY (DIGITAL IMAGING)

Objective: To develop a digital radiographic/fluoroscopic information handling system for use in the field.

Military Relevance: To decrease the logistic burden involved with the use of conventional film X-ray systems (eliminating film, film processors, chemicals, and water), to improve the resolution of images, and to decrease the exposure time of the patient to X-rays.

Progress: A 1-inch diameter viewing system (detector) and the system which transfers the radiographic information telephonically have been developed and are currently undergoing evaluation at the Uniform Services University of the Health Sciences (USUHS). Results to date are satisfactory. Final report is due 3Q85.

In-House Work Unit: Digital Radiography, DA0G9204, US Army Medical Bioengineering Research and Development Laboratory (Salisbury, L. L.).

Contract: Filmless Radiology (Digital Imaging), DA303237, Uniformed Services University of the Health Sciences School of Medicine (Allman, R. M.); Salisbury, L. L.

FLYWHEEL POWERED MOBILE X-RAY GENERATOR WITH FLUOROSCOPIC CAPABILITY

Objective: To develop a flywheel-powered mobile X-ray system that has the capability to produce both radiographic and fluoroscopic images for clinical and field use.

Military Relevance: To develop a smaller, more efficient, mobile field system capable of producing both radiographic and fluoroscopic images, thus reducing electrical energy demands.

Progress: A bench model has been designed, developed, and tested. A mobile unit is being developed with delivery scheduled for 2Q85.

Contract: Flywheel-Powered Mobile X-Ray Generator with Fluoroscopic Capability, DA0G9379, Instrumentation Systems Center, University of Wisconsin (Siedband, M. P.); Salisbury, L. L.

IMPROVED RADIOGRAPHIC VIEWING SYSTEM

Objective: To develop an improved, high resolution detector that digitalizes radiographic images.

Military Relevance: To improve the resolution of images, to decrease the exposure time of the patient to X-rays, and to decrease the logistic burden involved with the use of conventional film X-ray systems (eliminating film, film processors, chemicals, and water).

Progress: A 1-inch diameter, high resolution viewing system (detector) has been delivered to USAMBRDL and is being tested and evaluated. If this detector proves satisfactory, a full-size unit will be developed.

In-House Work Unit: Digital Radiography, DA0G9204, US Army Medical Bioengineering Research and Development Laboratory (Salisbury, L. L.).

Contract: An Improved Radiographic Viewing System, DA301080, Huntsville Electronics Division, Chrysler Corporation (George, E. W.); Salisbury, L. L.

ADAPTATION OF A COMMERCIAL PROTOTYPE DEMAND OXYGEN CONTROLLER TO MILITARY FIELD REQUIREMENTS

Objective: To evaluate an available device which significantly conserves medical oxygen by introducing a measured pulse of oxygen to the patient only upon inspiration.

Military Revelance: To greatly reduce the quantity of medical oxygen needed, thus reducing logistical support requirements.

Progress: Operational prototypes were received and forwarded to the Army Development and Employment Agency for user evaluation and to Walter Reed Army Medical Center for clinical evaluation.

Contract: Adaptation of a Commercial Prototype Demand Oxygen Controller to Military Field Requirements, DA0H0579, TriTec, Inc. (Sieracki, L. M.); Conway, W. H.

ENVIRONMENTAL PROTECTION CONTAINERS FOR MEDICAL SUPPLIES

Objective: To develop a container to protect freezable military medical items in an Arctic environment. This equipment will perform an ancillary function related to medical treatment in a field environment.

Military Revelance: There is currently no means of protecting freezable medical supplies (e.g., blood, drugs, and biologicals) in Arctic cold. This is vital to continuing the medical mission in extreme cold weather warfare.

Progress: The maintenance evaluation of the prototype was completed. The type classification In-Process Review (IPR) was accomplished by correspondence in 2Q84.

In-House Work Unit: Environmental Protection Containers for Medical Supplies, DA0A6290, US Army Medical Bioengineering Research and Development Laboratory (Conway, W. H.).

FAMILY OF MEDICAL EQUIPMENT PROTECTION CONTAINERS

Objective: To design, fabricate, and evaluate a set of strong, lightweight containers for fragile medical equipment that is presently authorized to field medical units.

Military Relevance: To reduce repairs and maintenance manpower time by assuring that fragile medical equipment is protected during handling, shipping, and storage.

Progress: The US Army Medical Materiel Development Activity (USAMMDA) has requested that no further effort be expended by USAMBRDL until an IPR can be convened to evaluate status and determine a future course of action.

In-House Work Unit: Family of Medical Equipment Protective Containers, DA0B6248, US Army Medical Bioengineering Research and Development Laboratory (Reams, W. H.).

ON-SITE MEDICAL OXYGEN GENERATING AND DISTRIBUTION SYSTEM

Objective: To develop a system that will produce medical grade oxygen on-site in the field.

Military Relevance: To reduce the great logistical burden of supplying large numbers of high pressure gas cylinders needed to treat combat casualties.

Progress: A Source Selection Board met in June 1984 and examined six proposals; three were selected for further consideration.

In-House Work Unit: On-Site Medical Oxygen Generating and Distribution System, DA0G9210, US Army Medical Bioengineering Research and Development Laboratory (Prensky, W. C.).

RESUSCITATION FLUIDS PRODUCTION AND RECONSTITUTION SYSTEM

Objective: To develop a system that will produce on-site medical grade water for injection from a potable water source.

Military Relevance: To greatly reduce the logistic burden of supplying prepackaged and premixed sterile solutions for injection that are necessary to treat casualties in combat areas.

Progress: A Request for Proposal (RFP) has been prepared in conjunction with the Navy and is expected to be advertised to the industrial community 2Q85.

In-House Work Unit: Resuscitation Fluids Production and Reconstitution System, DA0G9206, US Army Medical Bioengineering Research and Development Laboratory (Reams, W. H.).

CARRIER, LITTER, WHEELED

Objective: To provide a carrier device that facilitates patient transportation over various types of terrain and inside field hospitals.

Military Relevance: To facilitate moving patients over rough terrain and in field hospitals, to reduce the number of personnel required to move patients, and to utilize female soldiers in the role of litter bearers in field hospitals.

Progress: Engineering development tests and field tests in Honduras have been conducted on the West German and USAMBRDL versions of the carrier. An IPR package is being prepared.

In-House Work Unit: Carrier, Litter, Wheeled, DA0G5856, US Army Medical Bioengineering Research and Development Laboratory (Thayer, C. R.).

ETHYLENE OXIDE STERILIZATION (EOS) SYSTEM

Objective: To develop a sterilization system that will provide a fast, reliable, efficient ethylene oxide sterilization capability for Table of Organization and Equipment (TOE) field hospitals.

Military Relevance: No reliable field sterilization system exists for the preparation of reusable heat-labile medical equipment, especially plastic and rubber goods. Large quantities of such goods are already in field hospitals. Being able to reuse goods intended for one-time use would decrease logistic support. Ethylene oxide sterilization is the only fast, reliable, and efficient method to sterilize heat and pressure-sensitive medical items and is necessary for TOE field hospitals.

Progress: A contract was awarded and prototypes developed. Operational Test (OT) II was completed and test report is under analysis. Milestone III IPR is projected 2Q85.

In-House Work Unit: Ethylene Oxide Sterilization (EOS) System, DA0G9320, US Army Medical Bioengineering Research and Development Laboratory (Prensky, W. C.).

STEAM VACUUM PULSE STERILIZER (SVP) SYSTEM

Objective: To develop a sterilization system which will provide a fast, reliable, efficient, automatic item sterilization capability in TOE field hospitals.

Military Relevance: The substitution of a larger, faster, more efficient, and more reliable steam vacuum sterilizer system will improve support in field hospitals.

Progress: A contract was awarded and prototypes developed. OT II was completed and test report is under analysis. Milestone III IPR is projected 2Q85.

In-House Work Unit: Steam Vacuum Pulse Sterilizer (SVP) System, DA009318, US Army Medical Bioengineering Research and Development Laboratory (Prensky, W. C.).

LINER, HEATED PATIENT HOLDING AND EVACUATION SYSTEM

Objective: To develop a heated liner that can be inserted in the current insulated evacuation bag. The combination will maintain desired, controlled temperatures in extremely cold climates for prolonged period.

Military Relevance: To protect and prevent additional complications to casualties awaiting or being transported through the evacuation process in extremely cold climates.

Progress: Design, fabrication, and evaluation of developmental prototypes have been completed. Problems have been discovered with the pressure regulator at extremely low temperatures. The Norwegian Charcoal Fueled Unit is being interfaced with the USAMBRDL liner. Development tests on both prototypes are scheduled to begin 2Q85.

In-House Work Unit: Liner, Heated, Patient Holding and Evacuation System, DA0A6282, US Army Medical Bioengineering Research and Development Laboratory (Thayer, C. R.).

HIGH CAPACITY RADIOGRAPHIC SYSTEM FOR FIELD USE

Objective: To develop a modern, reliable, maintainable, transportable field medical radiographic and fluoroscopic system which is compatible with the military standard system.

Military Relevance: A modern, reliable system is needed to replace the present system to provide adequate health care.

Progress: A contract has been awarded to Picker International. Full-scale mock-ups will be delivered and set up at the Deployable Medical Systems (DEPMEDs) exercise at Fort Hood, TX. Six prototypes are scheduled for delivery 1Q86.

In-House Work Unit: High Capacity Radiographic System for Field Use, DA0B6250, US Army Medical Bioengineering Research and Development Laboratory (O'Connor, R. J.).

Contract: Military Transportable Field Radiographic and Fluoroscopic System, DA304538, Picker International Defense Division (Browne, D. W.); O'Connor, R. J.

REFRIGERATOR, MEDICAL FIELD

Objective: To develop or procure a lightweight, reliable, supportable medical field refrigerator to replace the current refrigerator that is no longer supportable.

Military Relevance: A biological refrigerator for the storage of perishable medical supplies is a necessity for field military units.

Progress: The Materiel Developer has directed all contractual efforts for development of a field refrigerator to stop. This has occurred and the solicitation previously advertised has been cancelled. Renewal of development efforts is dependent on IPR decisions following review of Academy of Health Sciences test results on a nondevelopmental item.

In-House Work Unit: Refrigerator, Medical, Field, DA0G0652, US Army Medical Bioengineering Research and Development Laboratory (O'Connor, R. J.).

VECTOR CONTROL SYSTEMS PROGRAM

Vector Control Systems Program addresses development or modification of commercially produced vector control equipment, materials, and methods to satisfy the special mission requirements of the Army in the field.

VECTOR CONTROL SYSTEMS TASKS

VECTOR CONTROL SCIENCE BASE

Objective: To continually acquire a vector control science base, ensuring a steady stream of new, innovative, and often novel approaches for effective control of arthropod vector populations.

Military Relevance: The military has historically adopted pest control technologies long after they have been proven in the civil sector. This has caused a lag resulting in the military acquisition of outmoded technology in order to perform its mission to support the combat soldier. Attempting to combat vector-borne diseases with outmoded technology will result in inefficiency, wastefulness, and failure to carry out the mission.

Progress: Basic research has been conducted in the area of integrated pest management. Through extensive field research, the rotary wing aerial dispersal of selective biological insecticides with diluents was developed. This method is significantly more effective in causing mortality of adult mosquitoes than the conventional methodology using technical grade insecticides.

In-House Work Unit: Vector Control Science Base, DA0G5997, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

VECTOR CONTROL METHODS, MATERIALS, EQUIPMENT

Objective: To develop threat projections, technological forecasts, and interagency planning to determine operational capabilities, doctrine, organization, and potential systems to meet Army vector control needs.

Military Relevance: Previous wartime experiences have demonstrated the devastating effect of outbreaks of arthropod-borne diseases on military operations. This task is aimed at providing the knowledge base for future investigations, formulating control concepts in early-on studies of systems, and evaluating experimental and commercial hardware. Identification and resolution of technical issues, operational issues, and logistical support problems are critical to the timely incorporation of new methodologies, materials, and equipment into the Army's vector control program.

Progress: Tests conducted in Panama confirmed that penetration of a double canopy by liquid pesticides can be achieved. The pesticide was delivered by a multicapability, helicopter slung, pesticide dispersal unit at twice the standard rate of application. In FY 85 testing will ascertain control of Aedes aegypti.

In-House Work Unit: Vector Control Methods, Materials, Equipment, DA0G8679, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

DELOUSING OUTFIT, POWER DRIVEN

Objective: To develop a delousing outfit from standard military and commercial components that is capable of accurately dispensing insecticides. It will be lighter, less bulky, and possess a more accurate dispersal system than the existing delousing outfit.

Military Relevance: Louse-borne disease has historically caused an adverse impact upon the health, morale, and welfare of both military organizations and the civilian populace. The ability to control the vectors of louse-borne disease is of paramount importance to field medical and quartermaster personnel. The existing equipment is logistically unsupportable and cannot accurately dispense the new generation of louse control pesticides.

Progress: Feasibility studies have been conducted to determine the most efficient motors and compressors available on the market. The product-improved nozzle assembly is being obtained through NRDC.

In-House Work Unit: Delousing Outfit, DA303165, US Army Medical Bioengineering Research and Development Laboratory (Anderson, L. M.).

INTEGRATED PEST MANAGEMENT - BLACK FLIES

Objective: To develop methods of long-term suppression of immature stages of black flies and short-term suppression of adults without adverse effect of the environment.

Military Relevance: Currently, black flies seasonally restrict use of vast military training areas at some CONUS installations. In parts of Africa and Central and South America they are the primary vector of onchocerciasis or river blindness, a disease of military importance. Effective vector control strategies will permit increased military training at those installations and will reduce the potential threat of casualties due to onchocerciasis.

Progress: Requirements for testing larvicides with delayed or long-term activity (e.g., juvenile hormone analogues, controlled-release formulations) were delineated. Methods for meeting these requirements were developed. An improved static bioassay system for toxicity testing, a new static replacement bioassay system, and a flow-through system for rearing black fly larvae and testing larval control strategies were designed.

In-House Work Unit: Integrated Pest Management - Black Flies, DA0B6244, US Army Medical Bioengineering Research and Development Laboratory (Vorgetts, L. J.).

INTEGRATED PEST MANAGEMENT - MOSQUITOES

Objective: To develop methods for mosquito control that integrate physical, chemical, and biological control methods to maintain effective control economically without undue damage to the environment. Baseline laboratory and field data on the efficacy of various insecticides for control of mosquito larvae will be collected and provided. Field application rates will be determined using this data.

Military Relevance: Troop casualties resulting from mosquito-borne diseases in conflicts prior to World War II exceeded combat related losses. Mosquito-related casualties in conflicts since 1950 have declined because of control efforts but remain a major threat to the success of combat operations in armed conflicts.

Progress: To correct deficiencies in existing test methods, a standardized bioassay was developed for measuring the effectiveness of formulations utilizing Bacillus thuringiensis var. israelensis (Bti) as the active ingredient. A similar effort for standardizing tests of controlled release Bti formulations using sedimentation rate as an indicator of activity was developed.

In-House Work Unit: Integrated Pest Management - Mosquitoes, DA0G0649, US Army Medical Bioengineering Research and Development Laboratory (Vorgetts, L. J.).

PESTICIDE DISPERSAL EVALUATION SET

Objective: To develop a pesticide field evaluation set capable of measuring ultra-low volume (ULV) droplet spectra and total pesticide amounts applied by military dispersal equipment.

Military Relevance: Accurate calibration of dispersal equipment is essential for the effective and economical usage of ULV pesticide formulations in providing protection from disease for the soldier. The dissemination of droplets that are too large for effective control can produce adverse environmental effects. Droplets that are too small are ineffective and pose a potential health threat.

Progress: A printer has been successfully interfaced with the droplet measuring device. Design of two methods for increasing droplet/probe contact under field conditions is in progress.

In-House Work Unit: Pesticide Dispersal Evaluation Set, DA0B6058, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

TECHNICAL FEASIBILITY TESTING OF VECTOR CONTROL EQUIPMENT

Objective: To determine the durability of commercially available ultra-low volume (ULV) and powered pesticide dispersal equipment by comparative engineering tests.

Military Relevance: New and improved commercial items are frequently presented to the DOD as potential standard items. Some are unfit and should not be procured. Centralized uniform testing of these items on a request basis is essential to procure quality equipment and to maintain state-of-the-art technology in pest control.

Progress: First article tests of the Hudson 1-gallon and 2-gallon sprayers, Curtis-Dyna handheld ULV sprayer, and Halaby Inc. handheld ULV sprayer have been completed. Reliability testing of the Micro-Gen G-4 sprayer has been completed.

In-House Work Unit: Technical Feasibility Testing (TFT) of Vector Control Equipment, DA0A6296, US Army Medical Bioengineering Research and Development Laboratory (Anderson, L. M.).

Conventional Weapons Demilitarization: A Health and Environmental Effects Data Base Assessment, DA302760, Department of Energy, Lawrence Livermore National Laboratory, (Layton, D.); Rosenblatt, D. H.

Smokes and Obscurants: A Health and Environmental Effects Data Base Assessment, DA302759, Department of Energy, Lawrence Livermore National Laboratory, (Shinn, J. H.); Rosenblatt, D. H.

Acute Toxicity of Smoke Screen Materials to Aquatic Organisms, DA303024, Department of Energy, Battelle Pacific Northwest Laboratories, (Poston, T. M.); van der Schalie, W. H.

Environmental Effect Studies on EA5763, DA306599, US Army Armament Munitions and Chemical Command, (Wentsel, R.S.); Gardner, H.S.

Evaluate and Characterize Mechanisms Controlling Transport, Fate and Effects of Army Smokes in the Aerosol Wind Tunnel, DA304087, Department of Energy, Battelle Pacific Northwest Laboratories, (van Voris, P.); Barkley, J. J.

Field Measurement and Model Evaluation Program for Assessment of the Environmental Effects of Military Smokes, DA304000, Department of Energy, Argonne National Laboratory, (Policastro, A. J.); Parmer, D. L.

Water Quality Criteria for Six Munitions Compounds, DA304532, Department of Energy, Oak Ridge National Laboratory, (Ross, R. H.); Parmer, D. L.

Continuation of Field Ecological Assessment Procedures to Evaluate the Environmental Effects of Using Large Area Training Smokes, DA306104, US Army Construction Engineering Research Laboratory, (Novak, E. M.); Parmer, D. L.

Determination of the Chronic Mammalian Toxicological Effects of TNT, DAOG0666, IIT Research Institute, (Lish, P. M.); Barkley, J. J.

Determination of the Toxicity to Aquatic Organisms of HMX and Related Wastewater Constituents, DAOG2232, EG&G Bionomics, (Petrocelli, S. R.); van der Schalie, W. H.

Environmental Fate of White Phosphorus/Felt and the Red Phosphorus/Butyl Rubber Military Screening Smokes, DA300100, SRI International, (Spanggord, R. J.); Barkley, J. J.

Terrestrial Microcosm Evaluation of Two Army Smoke-Producing Compounds, DA303077, Battelle Memorial Institute, (Duke, K. M.); Bratt, G. M.

A Health and Environmental Effects Data Base Assessment of US Army Waste Material, DA303914, Carltech Associates, Inc., (Uhrmacher, J. C.); Small, M. J.

ENVIRONMENTAL QUALITY RESEARCH PROGRAM

objective of the Environmental Quality Research Program is to conduct prehensive applied chemical, microbiological, toxicological and engineering earch to develop treatment technologies and ecological and human health ects data bases for pollutants and hazardous materials. This program is a ust Area of the Army's Environmental Quality Technology Program serving to fill part of the Army Surgeon General's environmental quality protection Installation Restoration mission requirements. The ultimate output of the earch program are treatment technologies, Environmental Quality Criteria uments and USEPA issued Medical Advisories. The areas of emphasis include itary smokes, conventional munitions production and demilitarization, solid wastes. During FY84 studies were continued to determine the ironmental fate and effects, mammalian and aquatic toxicity and treatment munitions wastewaters. The RDX data base was completed.

IRONMENTAL QUALITY TECHNOLOGY

Objective: The objective of the research area is to provide environmental and health effects data bases for Army-unique materials.

Military Relevance: The data bases developed under this research area are used to maintain readiness by protecting training areas from chemical damage and by providing guidelines for designing economical treatment processes to reduce the impact from discharges from Army industrial operations.

Progress: The objective is accomplished by studies to define, assess, characterize and document the environmental fate, effects and toxicities of pollutants. During FY84 the data base for RDX was completed. Data base assessments for military smokes, conventional munitions demilitarization procedures, and solid waste disposal methods along with a study to develop methods to estimate the physical/chemical properties of inorganics were continued. Studies to document and define the environmental fate, effects and aquatic toxicity of the military phosphorus and fog oil smokes, landfilled materials and munitions were initiated. Efforts were also begun that will result in the development of Medical Advisories for military relevant materials by the USEPA.

Contracts: Chemical Characterization and Toxicologic Evaluation of Airborne Mixtures, DAOG5136, Department of Energy, Oak Ridge National Laboratory, (Guerin, M. R.); Eaton, J. C.

Neurotoxicology of Cyclotrimethylenetrinitramine (RDX), DA300033, US Environmental Protection Agency, Health Effects Research Laboratory, (MacPhail, R.); Reddy, G.

Data Base Assessment of Health and Environmental Effects of Munition Production Waste Products, DA300877, Department of Energy, Oak Ridge National Laboratory, (Ensminger, J. T.); Rosencrance, A. B.

Progress: Chemical characterization of trace organics in dimethylsulfoxide munitions recrystallization process solvent was completed and the results are described in USAMBRDL Technical Report 8406. The GC/MS data system was further upgraded and its computer was utilized in automation of all the chromatographic instruments in in-house analytical chemistry laboratories.

In-House Work Units: Chemical Detection and Identification of Trichothecene Mycotoxins in Field Water Supplies, DA302673, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, E. P.).

Alkaline Hypochlorite Treatment of Trichothecenes: A Product Study, DA305524, US Army Medical Bioengineering Research and Development Laboratory, (E. P. Burrows).

Contract: Health Effects Research on Dimethylsulfoxide Munitions Recrystallization Process Solvent, Phase II, DA305606, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J. C.

WATER CHEMISTRY

Objective: To maintain state-of-the-art instrumentation and experienced personnel in water chemistry laboratory to conduct water and wastewater analyses and to develop analytical methods.

Military Relevance: To perform analyses in support of Army munition plant wastewater evaluations and in-house research and to develop analytical methods which address problems of interest to the Army.

Progress: Over the past year analytical methods have been completed for determining phenoxyacid herbicides by both HPLC and ion chromatography. A short-term bioassay for mycotoxins in water using brine shrimp has been developed. A prototype real-time atmospheric HCl monitor has been developed utilizing the midget impinger principle and flow injection analysis techniques.

In House Work Units: Adsorbents for the Recovery, Enrichment, and Transport of Chemical Warfare Agents Found in Water, DA302678, US Army Medical Bioengineering Research and Development Laboratory, (Hoke, S. H.).

Bioassay for Mycotoxins in Water Using Brine Shrimp Larvae, DA302681, US Army Medical Bioengineering Research and Development Laboratory, (Hoke, S. H.).

Development of a Monitor to Measure HCl Vapors Generated by Weapons Systems, Work Unit 032, US Army Medical Bioengineering Research and Development Laboratory, (Hoke, S. H.).

Determination of Phenoxyacid Herbicides by HPLC, DA305996, US Army Medical Bioengineering Research and Development Laboratory, (Hoke, S. H.).

FIELD SANITATION AND WATER

Objectives: Conduct preventive medicine research in field water supply and sanitation to enhance the readiness and operational capability of the soldier in combat and training.

Military Relevance: To increase the knowledge, analytical capability and problem solving ability of the field preventive medicine personnel in order to obviate exposure of troops to high risks of disease, illness or injury from consumption or contact with unsafe field water supplies, and from improper hygiene and sanitation procedures.

Progress: During FY84 new field water quality criteria recommendations were developed for: chlorides, sulfates, magnesium, cyanide, arsenic, color, turbidity, total dissolved solids, and radionuclides. Unique rapid field biotoxicity monitoring method was developed and a battery of n-chloramine compounds were examined for their capability to replace or enhance free available chlorine disinfection of water.

Contracts: Data Base Assessment of Environmental and Toxicological Factors in Water to Upgrade and Modernize Content of TB Med 577, DA300881, Department of Energy, Lawrence Livemore National Laboratory, (Anspaugh, L. R.); Schaub, S. A.

Evaluation of Field Water Data Base Assessment Study Deliverables, DA304816, Department of Energy, Oak Ridge National Laboratory, (Ross, R. H.); Schaub, S. A.

Chemistry and Toxicology of Water Treated with Hypochlorite to Detoxify Chemical Agent VX, DA305445, Department of Energy, Battelle Pacific Northwest Laboratories, (Kalkwarf, D. R.); Rosenblatt, D. H.

New Disinfection Agents for Water, DA300021, Auburn University, (Worley, S. D.); Eaton, J. C.

Literature Assessment of the Occupational Health Effects of Selected Trichothecene Mycotoxins of Military Medical Significance, DA301721, Carltech Associates, Inc., (Uhrmacher, J. C.); Bausum, H. T.

Rapid Bioassay Monitoring System for Water Quality, Phase II, Tasks 2-12, DA303278, Wyatt Technology Company, (Wyatt, P. J.); Schaub, S. A.

MASS SPECTROMETRY

Objective: To provide state-of-the-art in-house research capability in mass spectrometry to solve Army health and environmental problems.

Military Relevance: Areas of military relevance include occupational health and wastewater discharge from military installations and problems related to the presence of Army-derived chemicals and other toxic substances in the environment.

Contracts: Inhalation Toxicology of Fog Oil Obscurant, DAOG7492, US Environmental Protection Agency, Health Effects Research Laboratory, (Selgrade, M.); Finch, R. A.

Chemical Characterization and Toxicologic Evaluation of Airborne Mixtures, DAOG5136, Department of Energy, Oak Ridge National Laboratory, (Guerin, M. R.); Eaton, J. C.

Inhalation Toxicity of Manganese Dioxide and a Magnesium Oxide-Manganese Dioxide Mixture, 83PP3803, Department of Energy, Brookhaven National Laboratory, (Drew, R. T.); Bratt, G. M.

Mutagenesis Bioassays, 83PP3804, US Environmental Protection Agency, Health Effects Research Laboratory, (Lewtas, J.); Henry, M. C.

Studies on the Inhalation Toxicity of Dyes Present in Colored Smoke Munitions, 83PP3807, Department of Energy, Inhalation Toxicology Research Laboratory, Lovelace Biomedical and Environmental Research Institute, Inc., (Henderson, R. F.); Kelly, J. A.

Chemical and Physical Characterization of XM819 Red Phosphorus Sodium Nitrate Obscurant Aerosol, 84PP4827, Department of Energy, Oak Ridge National Laboratory, (Guerin, M. R.); Eaton, J. C.

Short-Term In Vitro Screening Studies Related to the Inhalation Toxicology of Potentially Toxic Aerosols, 84PP4850, US Environmental Protection Agency, Health Effects Research Laboratory, (Selgrade, M.); Finch, R. A.

Genotoxicity of Dyes Present in Colored Smoke Munitions, 85PP5801, Department of Energy, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Inc., (Henderson, R.); Kelly, J. A.

Comparative Inhalation Toxicology of Selected Materials, 85PP5805, Department of Energy, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Inc., (Snipes, M. B.); Henry, M. C.

Toxicity of DEGDN, Synthetic HC Smoke Combustion Products, Solvent Yellow 33 and Solvent Green 3 to Freshwater Aquatic Organisms, 85MM5505, Applied Physics Laboratory, The Johns Hopkins University, (Burton, D. J.); Kelly, J. A.

Bioassay of Military Relevant Compounds for Carcinogenic Activity by the Strain A Mouse Lung Tumor Bioassay, DAOG5090, Medical College of Ohio, (Stoner, G. D.), Finch, R. A.

Research and Development on Inhalation Toxicologic Evaluation of Red Phosphorus/Butyl Rubber Combustion Products, DAOH0386, IIT Research Institute, (Aranyi, C.); Finch, R. A.

Dermal, Eye and Oral Toxicologic Evaluations, DA300090, Bioassay Systems Corporation, (Muni, I. A.); Reddy, G.

Toxicity Studies on Lewisite and Sulfur Mustard Agents, DA305394, Department of Energy, Battelle Pacific Northwest Laboratories, (Sasser, L.); Finch, R. A.

FUELS AND LUBRICANTS

Objective: Assess the toxic effects of Army fuels and lubricants on soldiers and Department of the Army civilians and provide recommendations regarding fuel/lubricant sources, chemical constituents or use to minimize any deleterious health effects.

Military Relevance: The Army's use of fuels and lubricants of many varieties is widespread in both garrison and field environments. Toxic effects, to include performance effects, of the military use of these materials could have wide ranging impacts on mission performance.

Progress: Research was aimed at determining if shale derived diesel fuel is significantly different toxicologically from its more common petroleum derived counterpart. The scope of work for the fuel research project was revised to provide a more generic assessment of alternative source fuels. A diesel exhaust field study was initiated to define the major exhaust products produced by military diesel engines when burning both conventional petroleum derived fuel as well as shale derived diesel fuel. Analytical chemistry portions of both projects has recently begun.

Contracts: Army Synthetic and Altnerative Fuels Health Hazard Characterization, DAOH0036, Department of Energy, Oak Ridge National Laboratory, (Guerin, M. R.); Reddy, G.

Field Sampling and Analysis of Shale Oil Derived Airborne Diesel Exhausts, 84PP4867, Department of Energy, Oak Ridge National Laboratory, (Guerin, M.R.); Gardner, H.S.

SMOKE AND OBSCURANTS RESEARCH

Objective: Develop a health hazard data base on smoke and obscurants and to enable development of health protection guidelines and exposure criteria for occupational and field exposures which meet the users' needs.

Military Relevance: The application of preventive medicine research results to the operational community; reduce human performance degradation in combat, field training and military industrial plants.

Progress: Toxicology studies on three inventory and one product improved systems continued and are nearing completion. Research studies/efforts on three developmental systems were initiated. The M18 and XM76 fill materials exhibited slight irritant effects. The M18 fill materials did not exhibit carcinogenic potential, however, there may be some mutagenic potential. Phosphorus based fill materials in the M825, L8A1 and XM819 munitions give similar combustion products. The L8A1 fill material may produce fibrotic changes.

Evaluation of DEGDN (Diethyleneglycoldinitrate) and Two DEGDN Containing Compounds, DA305429, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Parmer, D. L.

Characterization of Combustion Products of Military Propellants, DAOG2223, IIT Research Institute, (Snelson, A.); Parmer, D. L.

Mortality of Munitions Workers Exposed to Dinitrotoluene, DAOG3440, Chemical Industry Institute of Toxicology, (Levine, R.J.); Parmer, D.L.

Toxicity Testing of DEGDN and DEGDN-Based Propellants, FAD-110, Letterman Army Institute of Research, (Korte, D. W.); Parmer, D. L.

CHEMICAL WEAPONS SYSTEMS

Objective: The objective of the projects grouped under this area are to conduct toxicological research to develop a complete health effects data base on selected chemical warfare agents.

Military Relevance: Specifically to investigate the potential for teratogenic/reproductive initiation, and for occupational exposures of military personnel, Army civilian and contract workers associated with the potential for exposure to chemical agents.

Progress: Toxicity studies on VX continued and the following draft final reports were reviewed: Ames mutagenesis assay, Saccharomyces bioassay, mouse lymphoma assay, teratology in rats, acute delayed neuropathy in chickens, and a 90-day subchronic study in rats. Teratology studies on GB, Type I and II, were completed in the rat and rabbit and were negative, i.e., GB was not lethal to the fetus, or was it teratogenic when administered at the high dose (380)g/kg bwt.) or below this dose level (240 and 100)g/kg bwt.). Studies on GD will commence following completion of the GB rabbit studies. Teratology studies on HD have been completed; studies on L are in the dose-range-finding stage. Toxicity studies on GB and GD, and HD and L, will commence in March/April 1985.

Contracts: Teratology Studies on Agent GB, DA300105, Food and Drug Administration, (LaBorde, J. B.), Dacre, J. C.

Toxicity Studies on Agent VX, DA300087, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J. C.

Teratology Studies on Lewisite and Sulfur Mustard Agents, DA302726, Department of Energy, Battelle Pacific Northwest Laboratories, (Hackett, P. L.); Finch, R. A.

Teratology Studies on Agent GD, DA302231, Food and Drug Administration, (LaBorde, J. B.); Dacre, J. C.

Toxicity Studies on Agents GB and GD, DA305392, Department of Energy, Laboratory for Energy-Related Research, (Goldman, M.); Dacre, J. C.

OCCUPATIONAL HEALTH RESEARCH PROGRAM

The occupational health research program has seven areas of research emphasis: conventional weapons, chemical weapons, fuels and lubricants, smoke and obscurants, field sanitation and water, mass spectrometry, and water chemistry. An overriding concern for all of these areas has been the inability to clearly ascertain the Army user's needs for health research. Several administrative mechanisms have been defined for some of the research areas, but an additional effort, especially by the chain of command, is needed to insure that occupational health research programs meet the needs of the soldier. The smoke and obscurants and chemical weapons research areas made significant progress toward establishing toxicological data bases. The bulk of these projects will be completed in the next couple of years. Attention is being directed in all subject areas to programs which define the actual exposure environment of the soldier and the medical demographics of individuals exposed. New concepts in defining performance degradation as a biological endpoint, as opposed to the more classical acute and chronic endpoints, are being actively explored.

CONVENTIONAL WEAPONS

Objective: To assess the acute, chronic and performance degradation potential of chemical substances associated with the Materiel Acquisition Cycle.

Military Relevance: Elimination of hazards due to chemical exposure in the military workplace will reduce death and non-battle injury.

Progress: Research efforts focused on evaluations of weapons combustion product hazards and ammunition product hazards in production facilities. Techniques for evaluatiing carbon monoxide exposure constituted the major research effort in the combustion products program, with the bulk of additional efforts focused on chemical analysis of combustion products. Ammunition products research has included assessing the hazards of new processes for RDX/HMX and diethyleneglycoldinitrate-based propellants.

Contracts: Human Health Studies of Carbon Monoxide (CO) Under Conditions of Military Weapon System Crewman Exposure, DAOG7486, US Environmental Protection Agency, Health Effects Research Laboratory, (Petrovick, M. L.); Reddy, G.

Neurobehavioral Effects of Carbon Monoxide (CO) Exposure to Humans, DAOG7494, US Environmental Protection Agency, Health Effects Research Laboratory, (Benignus, V. A.); Kelly, J. A.

Health Effects Research on Dimethylsulfoxide (DMSO) Munition Recrystallization Process Solvent, Phase II, DA305606, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J. C.

Bioassay of Military-Relevant Compounds for Carcinogenic Activity by the Strain A Mouse Lung Tumor Bioassay, DAOG5090, Medical College of Ohio, Stoner, G. D.); Finch, R. A.

The Development of a Mathematical Model to Describe the Fate of 2,4,6-Trinitrotoluene (TNT) in a Vascular Aquatic Plant System, DA301451, Tulane University, (Englande, A. J.); Gardner, H. S.

AQUATIC TOXICOLOGY

Objective: To conduct basic and applied research to determine the toxicity of Army-relevant materials to aquatic organisms.

Military Relevance: To improve the methods used to evaluate the toxicity of Army-relevant materials and to provide the data base required for assessing the hazard of these materials to aquatic organisms.

Progress: The toxicity to aquatic organisms of munitions-related materials, including quanidine, nitroguanidine, and nitroguanidine photolytic byproducts, was determined. Basic research was initiated to improve the ability of laboratory tests to predict the effects on aquatic organisms of the fluctuating toxicant concentrations which are typical of field conditions. Tests with four materials were successfully completed as part of a collaborative evaluation of a US Environmental Protection Agency daphnid chronic toxicity test protocol. Initial studies were conducted to determine whether fish could be used in relatively inexpensive in vivo carcinogenicity tests of Army-relevant materials. A proposed sublethal toxicity screening test involving automated monitoring of the ventilatory patterns of fish was evaluated using 1,3,5-trinitrobenzene and two fish species.

In-House Work Units: Basic Research in Aquatic Toxicology, DAOG8688, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W. H.).

Aquatic Toxicology Test Method Development, DA301054, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W. H.).

Screening of Military Relevant Chemicals for Toxicity to Aquatic Organisms, DAOB6188, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W. H.).

Development of an Automated Toxicant Screening Test Based on the Ventilatory Responses of Fish, DAOG0674, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W. H.).

Contract: Determination of the Toxicity to Aquatic Organisms of HMX and Related Wastewater Constituents, DAOG2232, EG&G Bionomics, (Petrocelli, S. R.); van der Schalie, W. H.

development of a suitable system concept for hazard assessment. Research trends for the occupational basic research program include determining toxic hazards associated with military-unique chemicals and developing predictive techniques for health hazards associated with military-unique exposures.

BASIC RESEARCH

Objective: Develop predictive models of adverse effects on humans and the environment from exposure to contaminants and determine toxic hazards created by military-unique chemicals and exposures.

Military Relevance: These models and protocols will provide more rapid, less expensive and more sensitive bases for hazard assessment studies of Army pollutants for contaminant clean-up, pollution control and protection of soldiers.

Progress: Studies on environmental effects models, hazard assessment concepts, reproductive hazard assessment, aquatic and mammalian tumorigenicity models, extrapolation models across species for respiratory tract disposition, and detection of performance decrements in animals under simulated military exposure conditions were continued. In flow-through model experiments with halomethane mixtures, medaka fish showed lower tumor incidences with longer latency periods than with other species. In environmental effects models, analyses showed that tissues from plants growing in solids contaminated with TNT wastewater showed no significant accumulations of TNT.

Contracts: Plant Uptake of 2,4,6-Trinitrotoluene (TNT), A Model for Polar Organic Compounds DA301895, US Army Waterways Experiment Station, (Folsom, B. L.); Gardner, H. S.

Biochemical, Pharmacological and Tumorigenic Effects on Drinking Water Carcinogens on Fish, DA301798, National Cancer Institute, (Kraybill, H. F.); Kelly, J. A.

Collaborative Research Program: Interlaboratory Testing of Aquatic Microcosm Protocol, DA302965, Food and Drug Administration, (Hoffman, B. L.); Dacre, J. C.

Histological, Histochemical, and Ultrastructural Characterization of Lesions in Fishes Exposed to Known Carcinogens with Emphasis on Neoplastic Development, DA302452, US Environmental Protection Agency, Environmental Research Laboratory, (Couch, J. A.); Kelly, J. A.

Extrapolation of Inhaled Particulate Toxicity Data from Experimental Animals to Humans, DA305393, US Environmental Protection Agency, Health Effects Research Laboratory, (Hatch, G. E.); Henry, M. C.

Computerization of a Preliminary Pollutant Limit Value Concept, DA304825, US Army Construction Engineering Research Laboratory, (Messenger, R. M.); Henry, M. C.

HEALTH EFFECTS RESEARCH DIVISION

The Health Effects Research Division (HERD) consists of a team of life scientists, chemists and engineers responsible for the planning and conduct of basic, occupational and environmental research programs. These programs are the research support elements for the Army preventive medicine and health hazard assessment missions. The research programs resulted in the development of complete biomedical or environmental data bases on unique military toxicants to provide the basis for criteria, standards and health or environmental decision making to promote the health of soldiers, DA civilians and the public, to promote environmental protection and to enhance mission performance. HERD staff members provide consultative services in a variety of science and engineering disciplines to OTSG, DA and other DOD elements.

BRANCHES

The Research Management Branch develops and manages extramural research in occupational health and environmental quality responsive to the needs and requests of the OTSG and the user communities of DA and DOD. The areas of primary emphasis are the health effects and risk assessments in (a) Chemical and Conventional Weapons, (b) Field Sanitation and Water, (c) Fuels and Lubricants, (d) Installation Restoration, and (e) Smoke and Obscurants. Basic research is performed to implement and facilitate analytical methodologies where time and costs need to be reduced. Research results may be used to help establish health effects exposure limits and standards; to reduce health and environmental risks in military training and operations, in demilitarization operations, in munitions manufacture, in waste disposal, and in site-specific, land use-specific considerations. In addition, consultative services in these areas as well as in chemistry, engineering, microbiology, and toxicology are provided as required to OTSG, DA, and DOD.

The Laboratory Research Branch conducts in-house research in analytical chemistry, environmental engineering, aquatic toxicology, and environmental microbiology in support of Defense Research Sciences, Systems Health Hazards Prevention Technology, and Environmental Quality Technology. Specialized areas of research include: development of analytical methods; chemical characterization of waste streams; synthesis of Army-unique chemicals; environmental fate studies; pilot-scale treatability studies; development of aquatic toxicity testing methods; standard acute and chronic aquatic toxicity testing; microbial fate and metabolic product studies; and microbial characterization of waters.

BASIC RESEARCH PROGRAM

Efforts in environmental quality basic research continues to accelerate the pace of hazard assessment research and to find alternate methods for providing valid criteria for contaminant clean-up and pollution control. Emphasis is on the development of environmental effects models, shorter term substitutes for mammalian toxicity models, in vitro tests, aquatic toxicity models, and

TRAP, MOSQUITO, LIGHT, COLLAPSIBLE

Objective: To develop a collapsible mosquito light trap which is powered solely from AC sources. The trap may be used with 110 volt outlets or with portable gasoline generators for disease vector and pest mosquito surveys. This will replace the standard mosquito light trap (NSN 3740-00-607-0337) which is noncollapsible and approaching obsolescence.

Military Relevance: Light traps are the primary method of detecting and estimating mosquito populations to establish disease transmission thresholds.

Progress: A prototype design has been fabricated. This prototype is undergoing field and laboratory testing to assure that it traps disease vectors in a more effective manner than existing traps. Testing will also determine durability and reliability.

In-House Work Unit: Trap, Mosquito, Light, Collapsible, DA0G0701, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

In-House Work Units: Pesticide Dispersal Unit, Multicapability, Helicopter Slung, DA305615, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

Pesticide Dispersal Unit, Solid, Helicopter Slung, DA0B6190, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

Pesticide Dispersal Unit, Liquid, Helicopter Slung, DA0B6195, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

PESTICIDE DISPERSAL UNIT, PORTABLE, BACKPACK

Objective: To identify a commercially available, lightweight, backpack unit capable of dispersing solid or liquid pesticide formulations. This unit would be used in combat zones and in CONUS for controlling disease vectors and pest arthropods.

Military Relevance: The unit is needed to disperse both liquid and solid pesticide formulations during field operations where vehicular or aerial disperal equipment cannot be used or is not readily available.

Progress: A type classification transition checklist was submitted to the US Army Troop Support Command (TROSCOM) on 11 July 1984. This Laboratory is awaiting receipt of the certification of transition.

In-House Work Unit: Pesticide Dispersal Unit, Portable, Backpack, DA0B6193, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

SPRAYER, POWERED, ULV, PORTABLE

Objective: To identify a commercially available, lightweight, portable unit capable of dispering ultra-low volume (ULV) pesticide formulations.

Military Relevance: Previous wartime experiences have demonstrated the devastating effects of outbreaks of arthropod-borne diseases on military operations. Many outbreaks start from a small localized area, too large for a field sanitation team to handle but too small for efficient treatment using vehicle-mounted equipment. A small portable ULV sprayer is the indicated equipment for local control of flies, mosquitoes, and other flying pests.

Progress: Two commerically available, gas-powered sprayers have been found suitable for procurement. Transition checklist was submitted to TROSCOM. This Laboratory is awaiting receipt of the certificate of transition.

In-House Work Unit: Sprayer, Powered, ULV, Portable, DA0G0677, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

CONTROLLED-RELEASE, ENVIRONMENTALLY DEGRADABLE, PESTICIDE FORMULATIONS

Objective: To identify and evaluate environmentally compatible, controlled-release pesticide formulations of military relevance for field use. These formulations will provide the military with a new series of effective pesticides for control of medically important arthropods.

Military Relevance: Controlled-release, environmentally degradable pesticide formulation systems are needed to replace the persistent, broad-spectrum pesticides, like dichloro-diphenyl-trichloro-ethane (DDT), that have been cancelled or suspended. The current formulations of new compounds are short-lived and have relatively short shelf life. These military shortcomings can be overcome through application of controlled-release technology. This should result in reduced pesticide usage.

Progress: Laboratory tests of first generation microencapsulated Bacillus thuringiensis (serotype 14) formulations were completed. Data from these studies were used to formulate second generation products using different size microcapsules and cell walls. The persistence of first generation formulations (5-10 days) is targeted to be increased to 21-30 days in second generation formulations. Two commercial, Bt (serotype 14) sustained release formulations were tested against Culex, Aedes, Anopheles species in the laboratory. Field tests of these formulations are scheduled.

In-House Work Unit: Controlled-Release, Environmentally Degradable, Pesticide Formulations, DA0B6223, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

PESTICIDE DISPERSAL UNIT, MULTICAPABILITY, HELICOPTER SLUNG

Objective: To identify a suitable commerical helicopter slung, dispersal unit for applying both liquid and solid formulations of insecticides, which would (a) dispense insecticides when slung beneath a helicopter, (b) require no modification of the aircraft, and (c) apply adequate swath widths and deposition rates for controlling arthropod disease vectors.

Military Relevance: Medical personnel engaged in field operations need the capacity for aerial dispersal of both liquid and solid pesticide formulations. The unit is needed to ensure rapid treatment of large areas inaccessible by ground equipment but too small for efficient use of larger aerial dispersal equipment. The current, internally mounted, dispersal unit is a health and safety hazard to the helicopter crew.

Progress: A multicapability unit, which is slung beneath a helicopter on the cargo hook, has been adapted for military use. The unit has been successfully tested in Panama 3Q84 and in the Philippines 4Q84.

Environmental Fate of Nitroguanidine, Diethyleneglycol Dinitrate, and Hexachloroethane Smoke, DA305052, SRI International, (Spanggord, R. J.); Kelly, J. A.

Mammalian Toxicity of New Propellants, FAD-AB, Letterman Army Institute of Research, (Korte, D. W.), Barkley, J. J.

ENVIRONMENTAL MICROBIOLOGY

Objective: The objective of this research is to detect and define the environmental longevity of pollutants, chemical substances and agents, and infectious agents which result from or are a threat to US Army operations.

Military Relevance: The US Army as a manufacturer and user of the propellant nitroguanidine is responsible to assess the environmental fate of chemical pollutants resulting from the manufacturing process. As potential chemical agents, simple assay systems are required for T_2 toxin and other trichothecene mycotoxins.

Progress: Results have indicated that the propellant precursor, guanidine nitrate, is biodegraded slowly in surface waters alone and relatively rapidly if present with metabolizable carbon, in which case the compound serves as a nitrogen source for microbial growth. A bioassay for the potential chemical agent, T_2 toxin, has been developed using the yeast Cryptococcus luteolus. The assay responds linearly from 2 to more than 30 micrograms of toxin, correlates with the relative toxicity of mouse LD50 assays for eight trichothecenes, and is more sensitive than that assay.

In-House Work Units: Environmental Fate: Guanidine Nitrate, Work Unit 032, US Army Medical Bioengineering Research and Development Laboratory, (Mitchell, W. R.).

Microbial Interactions with Guanidine, DA305995, US Army Medical Bioengineering Research and Development Laboratory, (Mitchell, W. R.).

Microbial Degradation and Yeast Bioassay of Trichothecene Mycotoxins, DA302675, US Army Medical Bioengineering Research and Development Laboratory, (Mitchell, W. R.).

Evaluation of the Effect of Antifoam Additive to Beef Extract Eluent on the Recovery of Enteroviruses from Water and Wastewater, DAOG0654, US Army Medical Bioengineering Research and Development Laboratory, (Taylor, G. W.).

ENVIRONMENTAL ENGINEERING

Objective: Research has been primarily directed toward development of treatment methods for wastewaters containing Army-unique chemicals of known or potential toxic hazard.

Military Relevance: This work relates to evaluation of public health and environmental health hazards associated with operation of Army industrial facilities.

Progress: During FY84 USAMBRDL collaborated with personnel from Radford and Sunflower Army Ammunition Plants to carry out successful pilot-scale studies on treatment of nitroguanidine wastewaters using carbon adsorption, and ultraviolet photolysis for control of nitroguanidine and ion exchange for removal of guanidinium salts. Bench-scale semicontinuous activate sludge studies on wastewaters from Composition B manufacture were completed at George Washington University, and the final report was published. Preparations were made for pilot-scale treatment of Holston Army Ammunition Plant wastewaters, to begin early in 1985.

In-House Work Units: Nitroguanidine Wastewater Pollution Control Technology Development, DA301041, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, W. D.).

Treatment of Munition Production Wastes, DA301069, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, W. D.).

Removal of Chemical Warfare Agents from Field Water Supplies by Reverse Osmosis: Development of Test Protocol and Efficacy Testing, DA303912, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, W. D.).

Contracts: Verification of Industrial Liquid Waste Treatment Plant Model at Holston Army Ammunition Plant, DAMD17-83-C-3211, University of South Florida, (Carnahan, R. P.), Burrows, W. D.

ANALYTICAL CHEMISTRY

Objective: To develop analytical techniques for qualitative and quantitative determination of pollutants in water and biological samples, and to carry out research and development on the health hazards of the disposal of chemical and other wastes of military relevance.

Military Relevance: The Army needs a quick and easy methodology for estimation of pollutants in the field, and at military installations, and to investigate suitable methods for removal and disposal of wastes.

Progress: During FY84 research efforts were directed at synthesizing and testing specific polymer adsorbents for TNT, RDX, HMX, and several pesticides. Analytical procedures were developed for TCPU in Gunpowder River water at Aberdeen Proving Ground. A diethylnitrosamine method, based on GC, was developed in connection with research underway in the Aquatic Toxicology Section. Synthetic methods for some large scale preparation of TCPU and nitrosoguanidine were developed.

In-House Work Units: Health Hazards of Disposal of Lithium/$SOCl_2$ Batteries, Work Unit 032, US Army Medical Bioengineering Research and Development Laboratory, (Kulkarni, R. K.).

Mobility and Bioaccumulation of Munition Incineration Ash, Work Unit 032, US Army Medical Bioengineering Research and Development Laboratory, (Kulkarni, R. K.).

Analytical Methods Development, Work Unit 032, US Army Medical Bioengineering Research and Development Laboratory, (Rosencrance, A. B.).

Pollutant Adsorbent Systems, DA305522, US Army Medical Bioengineering Research and Development Laboratory, (Kulkarni, R. K.).

Contract: Database Assessment of Health and Environmental Effects of Munition Production Wastes, DA300877, Department of Energy, Oak Ridge National Laboratory, (Ensminger, J. T.); Rosencrance, A. B.

INSTALLATION RESTORATION

Objective: To provide (1) new or revised methods for deriving maximum allowable levels of military-relevant chemical contaminants in soil or water, based on the physicochemical and toxicological properties of the contaminants, and on site-specific, land use-specific considerations; and (2) guidance and consultation to other military agencies on appropriate residual contaminant levels.

Military Relevance: As a particularly active member of the chemical manufacturing and user community, the Army is responsible for managing or excessing large tracts of land containing contaminated soil or water. This land must be so restored as to pose no significant risk to human health or to the environment.

Progress: In support of the US Army Toxic and Hazardous Materials Agency (USATHAMA) and the Department of Justice, a data base was assembled on over fifty compounds or ions associated with contamination at Rocky Mountain Arsenal. Appropriate criteria are being developed for analytical levels of these entities in soil and water, to make sure that the analyses by contractors will have adequate sensitivity. Consultation was being furnished to USATHAMA with regard to objectives for renovation of the former West Virginia Ordnance Works, the top priority "Superfund" site in West Virginia.

BIBLIOGRAPHY

Buescher, Michael D., L.C. Rutledge, R.A. Wirtz and J.H. Nelson. "Laboratory Repellent Tests Against Rhodnius prolixus (Heteroptera: Reduviidae)." Journal of Medical Entomology 22 (1985):49-53.

Burrows, Elizabeth P., E.E. Brueggemann and S.H. Hoke. "Chromatographic Trace Analysis of Guanidine, Substituted Guanidines and s-Triazines in Water." Chromatography 294 (1984):494-498.

Dacre, Jack C. "Toxicology of Some Anticholinesterases Used as Chemical Warfare Agents, A Review." Cholinesterases - Fundamental and Applied Aspects. Edited by M. Brzin, et al. (1984):425-426.

Goethals, Gerald B. "Radiation Therapy." AORN Journal 39 (1984):724.

Goethals, Gerald B. "An Introduction to Your Operation." AORN Journal 40 (1984):330.

Goethals, Gerald B. "So, You Want to be in Movies?" Today's OR Nurse 6 (1984):36-37.

Goyal, Sagar M., S.A. Schaub, F.M. Wellings, D. Bernard, J.S. Glass, C.J. Hurst, D.A. Brashear, C.A. Sorber, R.E. Moore, C. Ritter, P.H. Gibbs and S.R. Farrah. "Round Robin Investigations of Methods for Recovering Human Enteric Viruses From Sludge." Applied Environmental Microbiology 48(3) (1984):531-538.

Mitchell, Wayne R., S.H. Hoke and A.B. Rosencrance. "Microbial Degradation of 2,4,6-trichloroaniline in Aquatic Samples and Laboratory Enrichment Cultures." Environmental Science Health A19(6) (1984):679-696.

Burrows, Elizabeth P., E.E. Brueggemann, S.H. Hoke, E.H. McNamee and L.J. Baxter. Nitroguanidine Wastewater Pollution Control Technology: Phase II. Wastewater Characterization and Analytical Methods Development for Organics. Technical Report 8311 (1984).

Burrows, W. Dickinson. Tertiary Treatment of Effluent From Holston AAP Industrial Liquid Waste Treatment Facility. III. Ultraviolet Radiation and Ozone Studies: TNT, RDX, HMX, TAX and SEX. Technical Report 8306 (1983).

Carnahan, Robert P., P. Marsack and W.D. Burrows. Evaluation of Industrial Liquid Waste Treatment Plant Design at Holston Army Ammunition Plant Phase I, Part I. Technical Report 8401 (1984).

Dacre, Jack C. A Preliminary Toxicological Evaluation of Eight Chemicals Used as Wood Preservatives. Technical Report 8405 (1984).

Dennis, William H., Jr., A.B. Rosencrance, T.M. Trybus, C.W.R. Wade and E.A. Kobylinski. Treatment of Pesticide-Laden Wastewaters From Army Pest Control Facilities by Activated Carbon Filtration Using the Carbolator Treatment System. Technical Report 8203 (1983).

Kobylinski, Edmund A. and W.D. Burrows. Tertiary Treatment of Effluent From Holston AAP Industrial Liquid Waste Treatment Facility. II. Corona Oxidation Studies: TNT, RDX, HMX, TAX and SEX. Technical Report 8215 (1983).

Noss, Charles I. Evaluation of Alkaline Chemical Addition and Organic Loading Schemes for Enhancement of Secondary Treatment and Ancillary Nutrient Removal. Technical Report 8303 (1983)

Noss, Charles I. and R.H. Chyrek. Nitroguanidine Wastewater Pollution Control Technology: Phase III. Treatment With Ultraviolet Radiation, Ozone and Hydrogen Peroxide. Technical Report 8309 (1984).

Noss, Charles I. and R.H. Chyrek. Tertiary Treatment of Effluent From Holston AAP Industrial Liquid Waste Treatment Facility. IV. Ultraviolet Radiation and Hydrogen Peroxide Studies: TNT, RDX, HMX, TAX and SEX. Technical Report 8308 (1984).

Small, Mitchell J. Compounds Formed From the Chemical Decontamination of HD, GB and VX and Their Environmental Fate. Technical Report 8304 (1984).

Small, Mitchell J. Nitroguanidine Wastewater Pollution Control Technology: Phase III. Ion Exchange and Carbon Adsorption Treatment. Technical Report 8310 (1984).

Small, Mitchell J. The Preliminary Pollutant Limit Value Approach: Procedures and Data Base. Technical Report 8210 (1984).

van der Schalie, William H. The Acute and Chronic Toxicology of 3,5-Dinitroaniline, 1,3-Dinitrobenzene and 1,3,5-Trinitrobenzene to Freshwater Aquatic Organisms. Technical Report 8305 (1983).

Anderson, Leroy M. and J.H. Nelson. "Effect of Aedes aegypti larvae on the susceptibility of Toxorhynchites amboinensis to Bacillus thuringiensis serotype-14." Paper presented at the American Mosquito Control Association Annual Meeting, Toronto, Canada, March 1984.

Bratt, Gary M. "The Role of the US Army's Health Hazard Assessment Program in the Acquisition of Smoke/Obscurants." Abstract presented at Smoke/Obscurants Symposium VIII, Harry Diamond Laboratories, 24-26 April 1984, and published in Proceedings of Smoke Symposium VIII.

Burrows, W. Dickinson, R.H. Chyrek, C.I. Noss, M.J. Small and E.A. Kobylinski. "Treatment for Removal of Munition Chemicals From Army Industrial Wastewaters." Oral presentation at Mid-Atlantic Industrial Waste Conference and published in Mid-Atlantic Industrial Waste Conference Proceedings.

Burrows, W. Dickinson, R.H. Chyrek, E.A. Kobylinski, C.I. Noss and M.J. Small. "Treatment for Removal of Munitions From Army Industrial Wastewaters." Abstract presented at 16th Mid-Atlantic Industrial Waste Conference, Pennsylvania State University, 24-26 June 1984, and published in the Proceedings.

Burrows, W. Dickinson, S.A. Schaub and B.W. Peterman. "Field Reuse of Army Laundry and Shower Waters: Health Considerations." Oral presentation at Water Reuse Symposium III, San Diego, California, 28 August 1984, and published in Proceedings.

Duncan, James B. and W.D. Burrows. "Field Production of Water for Injection." Presented at Army Science Conference, West Point, 19-21 June 1984.

Eaton, James C. "Chemical Characterization and Toxicologic Evaluation of Diesel Fuel Aerosol." Abstract presented at Smoke Symposium VIII, Adelphi, Maryland, 24-26 April 1984, and published in Proceedings.

Eaton, James C. "Chemical Characterization and Toxicologic Evaluation of Diesel Fuel Aerosol." Published in Proceedings of Smoke/Obscurants Symposium VIII, 1984.

Rosenblatt, David H. "Considerations for the Use of Impure Recovered TNT." Abstract Presented at JANNAF Workshop on Reclamation/Reuse/Recovery of Propellants and Related Items, Redstone Arsenal, Huntsville, Alabama, 7 March 1984.

Rosenblatt, David H. and M.J. Small. "Pollutant Limit Value Calculations for Military Installations." Oral presentation and Meeting Paper presented at JANNAF Meeting, Las Cruces, New Mexico, 7-11 May 1984, and published in Meeting Paper.

Rosenblatt, David H. "Calculation of TNT and RDX Concentration Limits for Feedlot Water Supplies." Oral presentation at 21st Explosives Safety Seminar, Houston, Texas, 29 August 1984, and published in Proceedings.

Schaub, Stephen A. and W.D. Burrows. "Field Reuse of Army Laundry and Shower Waters; Health Considerations." Abstract presented at Water Reuse Symposium III, San Diego, California, 26-31 August 1984.

Vorgetts, L. Joseph, L.R. Hopps and J.P. Duncan. "Effect of Mosquito Larval Cadavers on Tests of Microencapsulated Formulations of Bacillus thuringiensis (serotype H-14)." Paper presented at the 17th International Congress of Entomology, Hamburg, West Germany, August 1984.

Gula, Philip R., Jr., J.E. Shankle and G.E. Toms, Jr. First Article Test of One Gallon Sprayer, Insecticide, Manually-Carried Hand-Operated-Compression. US Army Medical Bioengineering Research and Development Laboratory MR 2-84 (January 1984).

Gula, Philip R., Jr., J.E. Shankle and G.E. Toms, Jr. First Article Test of Two Gallon Sprayer, Insecticide, Manually-Carried Hand-Operated-Compression. US Army Medical Bioengineering Research and Development Laboratory MR 5-84 (March 1984).

Gula, Philip R., Jr., G.E. Toms, Jr., J.E. Shankle and J.W. Hodge, Jr. Developmental Test (DT I) Report. US Army Medical Bioengineering Research and Development Laboratory MR 1-84 (January 1984).

Gula, Philip R., Jr. and G.E. Toms, Jr. Developmental Test Report, Puritan-Bennett Gas-Powered Ventilator. US Army Medical Bioengineering Research and Development Laboratory MR 9-84 (July 1984).

Gula, Philip R., Jr. and G.E. Toms, Jr. Developmental Test Report, Mine Safety Appliances Gas-Powered Ventilator. US Army Medical Bioengineering Research and Development Laboratory MR 10-84 (July 1984).

Hodge, John W., Jr. Litter Pole Handle Load-Deflection Test. US Army Medical Bioengineering Research and Development Laboratory MR 4-84 (February 1984).

Hodge, John W., Jr., J.E. Shankle and G.E. Toms, Jr. Litter Covers, Polypropylene Mesh. US Army Medical Bioengineering Research and Development Laboratory MR 3-84 (January 1984).

Hodge, John W., Jr., J.E. Shankle, G.E. Toms, Jr. and P.R. Gula, Jr. Developmental Test Report (DT I). US Army Medical Bioengineering Research and Development Laboratory MR 7-84 (May 1984).

Hodge, John W., Jr. and G.E. Toms, Jr. Engineering Evaluation of Bilan Refrigerator. US Army Medical Bioengineering Research and Development Laboratory MR 16-83 (November 1983).

Hodge, John W., Jr. and G.E. Toms, Jr. SKEDCO™ Stretcher. US Army Medical Bioengineering Research and Development Laboratory MR 8-84 (May 1984).

Mitchell, Wayne R. Preliminary Results of Biodegradation Studies for Guanidine Nitrate. US Army Medical Bioengineering Research and Development Laboratory MR 6-84 (1984).

Buescher, Michael D. Laboratory Evaluation of Controlled Release BTI Formulations Against Selected Mosquito Vector Species. US Army Medical Research and Development Command Newsletter, Number 11 (January 1984).

Goethals, Gerald B. and W.C. Prensky. Steam Vacuum Pulse (SVP) and Ethylene Oxide Sterilization (EOS) Systems. US Army Medical Research and Development Command Newsletter, Number 13 (July 1984).

Goethals, Gerald B. Surgical Instruments: Care and Handling (Film). David & Geck, Danbury, Connecticut, 1984.

Henry, Mary C. Mutagenic Screening of Six Candidate Dyes for Colored Smoke Munitions in the Salmonella Reversion Assay. PO Report 9600, 1984.

Kelly, John A. The Use of Fish in Carcinogen Assays. Abstract in US Army Medical Research and Development Newsletter, 1984.

Kenyon, Katheryn E. EQT Information Exchange Bulletin/USAMBRDL. Environmental Quality Technology Exchange Bulletin, 3rd Issue, 1984.

Rosenblatt, David H. The Name of the Game. (Guest Editorial) Environmental Science and Technology, Volume 18, p. 39A, February 1984.

DISTRIBUTION LIST

No. of Copies	
5	Commander US Army Medical Research and Development Command ATTN: SGRD-RMS Fort Detrick Frederick, MD 21701
1	Commander US Army Research Institute of Environmental Medicine (USARIEM) Bldg. 52 Natick, MA 01760
1	Commander US Army Medical Research Institute of Infectious Diseases (USAMRIID) Bldg. 1425 Fort Detrick Frederick, MD 21701
1	Commander Letterman Army Institute of Research (LAIR) Bldg. 1110 Presidio of San Francisco, CA 94129
1	Director Walter Reed Army Institute of Research (WRAIR) Bldg. 40 Washington, DC 20307
1	Commander US Army Medical Research Institute of Chemical Defense (USAMRICD) Bldg. E3100 Edgewood Area Aberdeen Proving Ground, MD 21010
1	Commander US Army Institute of Dental Research (USAIDR) Bldg. 40 Washington, DC 20307
1	Commander US Army Aeromedical Research Laboratory (USAARL) Bldg. 8708 Fort Rucker, AL 36362

No. of Copies	
1	Commander US Army Institute of Surgical Research (USAISR) Bldg. 2653 Fort Sam Houston, TX 78234
1	Commander US Army Medical Materiel Development Activity Fort Detrick Frederick, MD 21701
12	Defense Technical Information Center ATTN: DTIC-DDA Alexandria, VA 22314
1	Commandant Academy of Health Sciences, US Army ATTN: AHS-CDM Fort Sam Houston, TX 78234
1	Dir of Biol & Med Sciences Div Office of Naval Research 800 N. Quincy Street Arlington, VA 22217
1	CO, Naval Medical R&D Command National Naval Medical Center Bethesda, MD 20014
1	HQ AFMSC/SGPA Brooks AFB, TX 78235
1	Director of Defense Research and Engineering ATTN: Assistant Director (Environmental & Life Sciences) Washington, DC 20301
2	OTSG (DASG-HCL-P) WASH DC 20310